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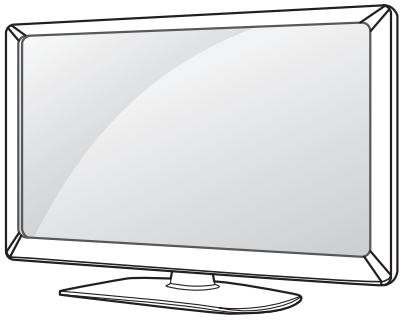
LED LCD TV
SERVICE MANUAL

CHASSIS : LB21A

MODEL : 22LS3500 22LS3500-TB
22LS3700 22LS3700-TB

CAUTION
BEFORE SERVICING THE CHASSIS,
READ THE SAFETY PRECAUTIONS IN THIS MANUAL.



P/NO : MFL67440118 (1202-REV00)

Printed in Korea

CONTENTS

SAFETY PRECAUTIONS

IMPORTANT SAFETY NOTICE

Many electrical and mechanical parts in this chassis have special safety-related characteristics. These parts are identified by ⚠ in the Schematic Diagram and Exploded View.
It is essential that these special safety parts should be replaced with the same components as recommended in this manual to prevent Shock, Fire, or other Hazards.
Do not modify the original design without permission of manufacturer.

General Guidance

An **isolation Transformer should always be used** during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks.

It will also protect the receiver and it's components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

If any fuse (or Fusible Resistor) in this TV receiver is blown, replace it with the specified.

When replacing a high wattage resistor (Oxide Metal Film Resistor, over 1 W), keep the resistor 10 mm away from PCB.

Keep wires away from high voltage or high temperature parts.

Before returning the receiver to the customer,

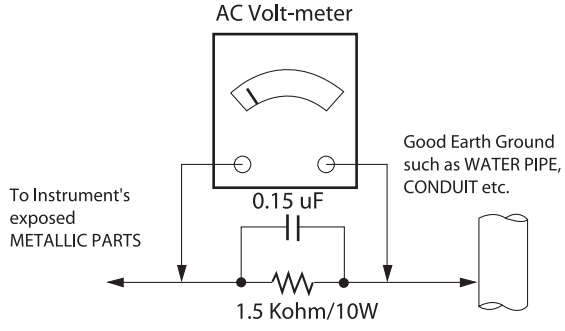
always perform an **AC leakage current check** on the exposed metallic parts of the cabinet, such as antennas, terminals, etc., to be sure the set is safe to operate without damage of electrical shock.

Leakage Current Cold Check(Antenna Cold Check)
With the instrument AC plug removed from AC source, connect an electrical jumper across the two AC plug prongs. Place the AC switch in the on position, connect one lead of ohm-meter to the AC plug prongs tied together and touch other ohm-meter lead in turn to each exposed metallic parts such as antenna terminals, phone jacks, etc.
If the exposed metallic part has a return path to the chassis, the measured resistance should be between 1 MΩ and 5.2 MΩ.
When the exposed metal has no return path to the chassis the reading must be infinite.
An other abnormality exists that must be corrected before the receiver is returned to the customer.

Leakage Current Hot Check (See below Figure)
Plug the AC cord directly into the AC outlet.

Do not use a line Isolation Transformer during this check.
Connect 1.5 K / 10 watt resistor in parallel with a 0.15 uF capacitor between a known good earth ground (Water Pipe, Conduit, etc.) and the exposed metallic parts.
Measure the AC voltage across the resistor using AC voltmeter with 1000 ohms/volt or more sensitivity.
Reverse plug the AC cord into the AC outlet and repeat AC voltage measurements for each exposed metallic part. Any voltage measured must not exceed 0.75 volt RMS which is corresponds to 0.5 mA.
In case any measurement is out of the limits specified, there is possibility of shock hazard and the set must be checked and repaired before it is returned to the customer.

Leakage Current Hot Check circuit



When 25A is impressed between Earth and 2nd Ground for 1 second, Resistance must be less than 0.1 Ω
*Base on Adjustment standard

SERVICING PRECAUTIONS

CAUTION: Before servicing receivers covered by this service manual and its supplements and addenda, read and follow the *SAFETY PRECAUTIONS* on page 3 of this publication.
NOTE: If unforeseen circumstances create conflict between the following servicing precautions and any of the safety precautions on page 3 of this publication, always follow the safety precautions. Remember: Safety First.

General Servicing Precautions

1. Always unplug the receiver AC power cord from the AC power source before;
   a. Removing or reinstalling any component, circuit board module or any other receiver assembly.
   b. Disconnecting or reconnecting any receiver electrical plug or other electrical connection.
   c. Connecting a test substitute in parallel with an electrolytic capacitor in the receiver.
   CAUTION: A wrong part substitution or incorrect polarity installation of electrolytic capacitors may result in an explosion hazard.
2. Test high voltage only by measuring it with an appropriate high voltage meter or other voltage measuring device (DVM, FETVOM, etc) equipped with a suitable high voltage probe. Do not test high voltage by "drawing an arc".
3. Do not spray chemicals on or near this receiver or any of its assemblies.
4. Unless specified otherwise in this service manual, clean electrical contacts only by applying the following mixture to the contacts with a pipe cleaner, cotton-tipped stick or comparable non-abrasive applicator; 10 % (by volume) Acetone and 90 % (by volume) isopropyl alcohol (90 % - 99 % strength)
   CAUTION: This is a flammable mixture.
   Unless specified otherwise in this service manual, lubrication of contacts in not required.
5. Do not defeat any plug/socket B+ voltage interlocks with which receivers covered by this service manual might be equipped.
6. Do not apply AC power to this instrument and/or any of its electrical assemblies unless all solid-state device heat sinks are correctly installed.
7. Always connect the test receiver ground lead to the receiver chassis ground before connecting the test receiver positive lead.
   Always remove the test receiver ground lead last.
8. Use with this receiver only the test fixtures specified in this service manual.
   CAUTION: Do not connect the test fixture ground strap to any heat sink in this receiver.

Electrostatically Sensitive (ES) Devices

Some semiconductor (solid-state) devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive (ES) Devices. Examples of typical ES devices are integrated circuits and some field-effect transistors and semiconductor “chip” components. The following techniques should be used to help reduce the incidence of component damage caused by static by static electricity.

1. Immediately before handling any semiconductor component or semiconductor-equipped assembly, drain off any electrostatic charge on your body by touching a known earth ground. Alternatively, obtain and wear a commercially available discharging wrist strap device, which should be removed to prevent potential shock reasons prior to applying power to the unit under test.
2. After removing an electrical assembly equipped with ES devices, place the assembly on a conductive surface such as aluminum foil, to prevent electrostatic charge buildup or exposure of the assembly.
3. Use only a grounded-tip soldering iron to solder or unsolder ES devices.
4. Use only an anti-static type solder removal device. Some solder removal devices not classified as “anti-static” can generate electrical charges sufficient to damage ES devices.
5. Do not use freon-propelled chemicals. These can generate electrical charges sufficient to damage ES devices.
6. Do not remove a replacement ES device from its protective package until immediately before you are ready to install it. (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, aluminum foil or comparable conductive material).
7. Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed.
   CAUTION: Be sure no power is applied to the chassis or circuit, and observe all other safety precautions.
8. Minimize bodily motions when handling unpackaged replacement ES devices. (Otherwise harmless motion such as the brushing together of your clothes fabric or the lifting of your foot from a carpeted floor can generate static electricity sufficient to damage an ES device.)

General Soldering Guidelines

1. Use a grounded-tip, low-wattage soldering iron and appropriate tip size and shape that will maintain tip temperature within the range or 500 °F to 600 °F.
2. Use an appropriate gauge of RMA resin-core solder composed of 60 parts tin/40 parts lead.
3. Keep the soldering iron tip clean and well tinned.
4. Thoroughly clean the surfaces to be soldered. Use a mall wire-bristle (0.5 inch, or 1.25 cm) brush with a metal handle. Do not use freon-propelled spray-on cleaners.
5. Use the following unsoldering technique
   a. Allow the soldering iron tip to reach normal temperature. (500 °F to 600 °F)
   b. Heat the component lead until the solder melts.
   c. Quickly draw the melted solder with an anti-static, suction-type solder removal device or with solder braid.
   CAUTION: Work quickly to avoid overheating the circuit board printed foil.
6. Use the following soldering technique.
   a. Allow the soldering iron tip to reach a normal temperature (500 °F to 600 °F)
   b. First, hold the soldering iron tip and solder the strand against the component lead until the solder melts.
   c. Quickly move the soldering iron tip to the junction of the component lead and the printed circuit foil, and hold it there only until the solder flows onto and around both the component lead and the foil.
   CAUTION: Work quickly to avoid overheating the circuit board printed foil.
   d. Closely inspect the solder area and remove any excess or splashed solder with a small wire-bristle brush.

IC Remove/Replacement
Some chassis circuit boards have slotted holes (oblong) through which the IC leads are inserted and then bent flat against the circuit foil. When holes are the slotted type, the following technique should be used to remove and replace the IC. When working with boards using the familiar round hole, use the standard technique as outlined in paragraphs 5 and 6 above.

Removal
1. Desolder and straighten each IC lead in one operation by gently prying up on the lead with the soldering iron tip as the solder melts.
2. Draw away the melted solder with an anti-static suction-type solder removal device (or with solder braid) before removing the IC.

Replacement
1. Carefully insert the replacement IC in the circuit board.
2. Carefully bend each IC lead against the circuit foil pad and solder it.
3. Clean the soldered areas with a small wire-bristle brush. (It is not necessary to reapply acrylic coating to the areas).

"Small-Signal" Discrete Transistor Removal/Replacement
1. Remove the defective transistor by clipping its leads as close as possible to the component body.
2. Bend into a "U" shape the end of each of three leads remaining on the circuit board.
3. Bend into a "U" shape the replacement transistor leads.
4. Connect the replacement transistor leads to the corresponding leads extending from the circuit board and crimp the "U" with long nose pliers to insure metal to metal contact then solder each connection.

Power Output, Transistor Device
Removal/Replacement
1. Heat and remove all solder from around the transistor leads.
2. Remove the heat sink mounting screw (if so equipped).
3. Carefully remove the transistor from the heat sink of the circuit board.
4. Insert new transistor in the circuit board.
5. Solder each transistor lead, and clip off excess lead.
6. Replace heat sink.

Diode Removal/Replacement
1. Remove defective diode by clipping its leads as close as possible to diode body.
2. Bend the two remaining leads perpendicular y to the circuit board.
3. Observing diode polarity, wrap each lead of the new diode around the corresponding lead on the circuit board.
4. Securely crimp each connection and solder it.
5. Inspect (on the circuit board copper side) the solder joints of the two "original" leads. If they are not shiny, reheat them and if necessary, apply additional solder.

Fuse and Conventional Resistor
Removal/Replacement
1. Clip each fuse or resistor lead at top of the circuit board hollow stake.
2. Securely crimp the leads of replacement component around notch at stake top.
3. Solder the connections.
   CAUTION: Maintain original spacing between the replaced component and adjacent components and the circuit board to prevent excessive component temperatures.

Circuit Board Foil Repair
Excessive heat applied to the copper foil of any printed circuit board will weaken the adhesive that bonds the foil to the circuit board causing the foil to separate from or "lift-off" the board. The following guidelines and procedures should be followed whenever this condition is encountered.

At IC Connections
To repair a defective copper pattern at IC connections use the following procedure to install a jumper wire on the copper pattern side of the circuit board. (Use this technique only on IC connections).

1. Carefully remove the damaged copper pattern with a sharp knife. (Remove only as much copper as absolutely necessary).
2. carefully scratch away the solder resist and acrylic coating (if used) from the end of the remaining copper pattern.
3. Bend a small "U" in one end of a small gauge jumper wire and carefully crimp it around the IC pin. Solder the IC connection.
4. Route the jumper wire along the path of the out-away copper pattern and let it overlap the previously scraped end of the good copper pattern. Solder the overlapped area and clip off any excess jumper wire.

At Other Connections
Use the following technique to repair the defective copper pattern at connections other than IC Pins. This technique involves the installation of a jumper wire on the component side of the circuit board.

1. Remove the defective copper pattern with a sharp knife. Remove at least 1/4 inch of copper, to ensure that a hazardous condition will not exist if the jumper wire opens.
2. Trace along the copper pattern from both sides of the pattern break and locate the nearest component that is directly connected to the affected copper pattern.
3. Connect insulated 20-gauge jumper wire from the lead of the nearest component on one side of the pattern break to the lead of the nearest component on the other side.
   Carefully crimp and solder the connections.
   CAUTION: Be sure the insulated jumper wire is dressed so the it does not touch components or sharp edges.

SPECIFICATION

NOTE : Specifications and others are subject to change without notice for improvement.

1. Application range

This specification is applied to the LCD TV used LB21A chassis.

2. Requirement for Test

Each part is tested as below without special appointment.

1) Temperature: 25 °C ± 5 °C(77 °F ± 9 °F), CST: 40 °C ± 5 °C
2) Relative Humidity: 65 % ± 10 %
3) Power Voltage
   : Standard input voltage (AC 100-240 V~, 50/60 Hz)
   * Standard Voltage of each products is marked by models.
4) Specification and performance of each parts are followed each drawing and specification by part number in accordance with BOM.
5) The receiver must be operated for about 5 minutes prior to the adjustment.

3. Test method

1) Performance: LGE TV test method followed
2) Demanded other specification
   - Safety : CE, IEC specification
   - EMC : CE, IEC

4. Model General Specification

No.	Item	Specification	Remarks
1.	Market	Austrailia, New Zealand, Singapore, Malaysia, Vietnam, Indonesia, South Africa, Israel, A-ASIA	only Analog for A-ASIA
2.	Broadcasting system	1) PAL/SECAM-B/G/D/K 2) PAL-I/II 3) NTSC-M 4) DVB-T	PAL for NZ/SG
3.	Channel Storage	ATV - 135EA, DTV - 1000EA	
4.	Receiving system	Analog : Upper Heterodyne Digital : COFDM(DVB-T)	▪ DVB-T - Guard Interval(Bitrate_Mbit/s) 1/4, 1/8, 1/16, 1/32 - Modulation : Code Rate QPSK : 1/2, 2/3, 3/4, 5/6, 7/8 16-QAM : 1/2, 2/3, 3/4, 5/6, 7/8 64-QAM : 1/2, 2/3, 3/4, 5/6, 7/8
5.	Video(Composite) Input	PAL, SECAM, NTSC	4 System : PAL, SECAM, NTSC, PAL60
6.	Component Input	Y/Cb/Cr, Y/Pb/Pr	
7.	RGB Input	RGB-PC	Analog (D-sub 15PIN)
8.	HDMI Input	HDMI1-DTV/DVI HDMI2-DTV/DVI HDMI3-DTV	PC - Non 3D HD/FHD Model : HDMI version 1.3 - 3D Model : HDMI version 1.4a Support HDCP
9.	Audio Input	RGB/DVI audio, Component, AV	
10.	SPDIF out	SPDIF out	
11.	USB	For My Media(Movie/Photo/Music List) or SVC	
12.	LAN	DLNA	Only LB21B

5. Component Video Input (Y, P_B, P_R)

No.	Resolution	H-freq(kHz)	V-freq(Hz)	Pixel clock(MHz)	Proposed
1	720*480i	15.73	59.94	13.500	SDTV, DVD 480I(525I)
2	720*480i	15.73	60.00	13.514	SDTV, DVD 480I(525I)
3	720*576i	15.625	50.00	13.500	SDTV, DVD 576I(625I) 50Hz
4	720*480p	31.47	59.94	27.000	SDTV 480P
5	720*480p	31.50	60.00	27.027	SDTV 480P
6	720*576p	31.25	50.00	27.000	SDTV 576P 50Hz
7	1280*720	44.96	59.94	74.176	HDTV 720P
8	1280*720	45.00	60.00	74.250	HDTV 720P
9	1280*720	37.50	50.00	74.25	HDTV 720P 50Hz
10	1920*1080	28.125	50.00	74.250	HDTV 1080I 50Hz
11	1920*1080	33.72	59.94	74.176	HDTV 1080I
12	1920*1080	33.75	60.00	74.25	HDTV 1080I
13	1920*1080	26.97	23.976	63.296	HDTV 1080P
14	1920*1080	27.00	24.000	63.36	HDTV 1080P
15	1920*1080	33.71	29.97	79.120	HDTV 1080P
16	1920*1080	33.75	30.00	79.20	HDTV 1080P
17	1920*1080	56.25	50	148.5	HDTV 1080P
18	1920*1080	67.432	59.94	148.350	HDTV 1080P
19	1920*1080	67.5	60.00	148.5	HDTV 1080P

6. RGB (PC)

No.	Resolution	H-freq(kHz)	V-freq.(Hz)	Pixel clock(MHz)	Proposed	Remarks
1	640*350	31.468	70.09	25.17	EGA	
2	720*400	31.469	70.09	28.32	DOS	
3	640*480	31.469	3.	640*480	31.469	
4	800*600	37.879	60.317	40	VESA(SVGA)	
5	1024*768	48.363	60.004	65	VESA(XGA)	
6	1360*768	47.712	60.015	84.75	VESA(WXGA)	
7	1920*1080	66.587	59.934	138.50	WUXGA (Reduced Blanking)	Only FHD Model

7. HDMI Input

(1) DTV Mode

No.	Resolution	H-freq(kHz)	V-freq.(kHz)	Pixel clock(MHz)	Proposed	Remarks
1	720*480	15.73	59.94	13.500	SDTV, DVD 480I(525I)	Spec. out but display
2	720*480	15.75	60.00	13.514	SDTV, DVD 480I(525I)	
3	720*576	15.625	50.00	13.500	SDTV, DVD 576I(625I) 50Hz	
4	720*480	31.47	59.94	27	SDTV 480P	
5	720*480	31.5	60.00	27.027	SDTV 480P	
6	720*576	31.25	50.00	27	SDTV 576P	
7	1280*720	44.96	59.94	74.176	HDTV 720P	
8	1280*720	45	60.00	74.25	HDTV 720P	
9	1280*720	37.5	50.00	74.25	HDTV 720P	
10	1920*1080	28.125	50.00	74.25	HDTV 1080I	
11	1920*1080	33.72	59.94	74.176	HDTV 1080I	
12	1920*1080	33.75	60.00	74.25	HDTV 1080I	
13	1920*1080	26.97	23.976	63.296	HDTV 1080P	
14	1920*1080	27.00	24.000	63.36	HDTV 1080P	
15	1920*1080	33.71	29.97	79.120	HDTV 1080P	
16	1920*1080	33.75	30.00	79.20	HDTV 1080P	
17	1920*1080	56.25	50.00	148.5	HDTV 1080P	
18	1920*1080	67.432	59.94	148.350	HDTV 1080P	
19	1920*1080	67.5	60.00	148.5	HDTV 1080P	

(2) PC Mode

No.	Resolution	H-freq(kHz)	V-freq.(Hz)	Pixel clock(MHz)	Proposed	Remarks
1	640*350	31.468	70.09	25.17	EGA	
2	720*400	31.469	70.09	28.32	DOS	
3	640*480	31.469	59.94	25.17	VESA(VGA)	
4	800*600	37.879	60.317	40	VESA(SVGA)	
5	1024*768	48.363	60.004	65	VESA(XGA)	
6	1152*864	54.348	60.053	80.002	VESA(VGA)	
7	1360*768	47.712	60.015	84.75	VESA(WXGA)	
8	1280*1024	63.981	60.02	109.00	SXGA	Only FHD Model (Support to HDMNI-PC)
9	1920*1080	67.5	60	158.40	WUXGA (Reduced Blanking)	Only FHD Model

ADJUSTMENT INSTRUCTION

1. Application Range

This specification sheet is applied to all of the LCD TV with LB21A chassis.

2. Designation

(1) The adjustment is according to the order which is designated and which must be followed, according to the plan which can be changed only on agreeing.
(2) Power adjustment : Free Voltage.
(3) Magnetic Field Condition: Nil.
(4) Input signal Unit: Product Specification Standard.
(5) Reserve after operation : Above 5 Minutes (Heat Run)
Temperature : at 25 °C ± 5 °C
Relative humidity : 65 ± 10 %
Input voltage : 220 V, 60 Hz
(6) Adjustment equipments: Color Analyzer(CA-210 or CA-110), DDC Adjustment Jig, Service remote control.
(7) Push the "IN STOP" key - For memory initialization.

Case1 : Software version up
1. After downloading S/W by USB , TV set will reboot automatically.
2. Push “In-stop” key.
3. Push “Power on” key.
4. Function inspection
5. After function inspection, Push “In-stop” key.

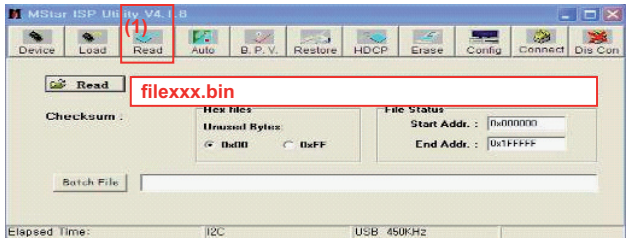
Case2 : Function check at the assembly line
1. When TV set is entering on the assembly line, Push “In-stop” key at first.
2. Push “Power on” key for turning it on.
→ If you push “Power on” key, TV set will recover channel information by itself.
3. After function inspection, Push “In-stop” key.

3. Main PCB check process

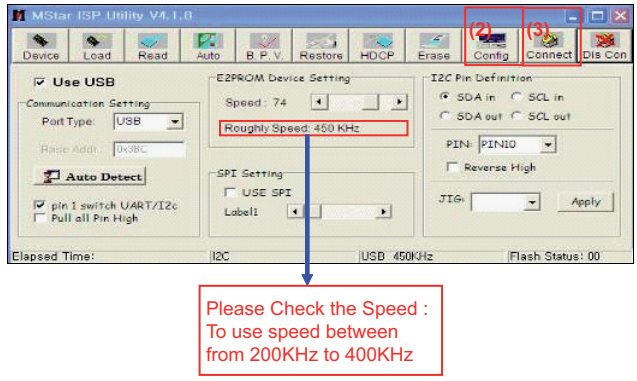
▪ APC - After Manual-Insert, executing APC

* Boot file Download

(1) Execute ISP program "Mstar ISP Utility" and then click "Config" tab.
(2) Set as below, and then click "Auto Detect" and check "OK" message.
If "Error" is displayed, check connection between computer, jig, and set.
(3) Click "Read" tab, and then load download file(XXXX.bin) by clicking "Read"

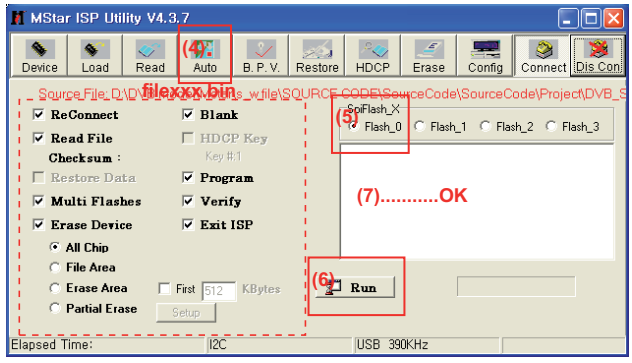


(4) Click "Connect" tab. If "Can't" is displayed, check connection between computer, jig, and set.



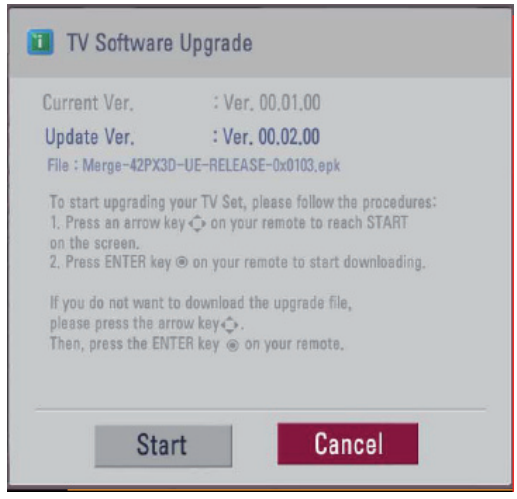
Please Check the Speed :
To use speed between
from 200KHz to 400KHz

(5) Click "Auto" tab and set as below.
(6) Click "Run".
(7) After downloading, check "OK" message.

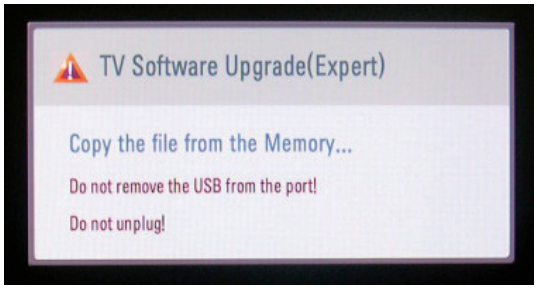


* USB DOWNLOAD

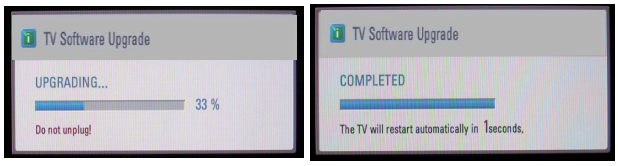
(1) Put the USB Stick to the USB socket.
(2) Automatically detecting update file in USB Stick.
- If your downloaded program version in USB Stick is Low, it didn't work. But your downloaded version is High, USB data is automatically detecting.



(3) Show the message "Copying files from memory".



(4) Updating is starting.



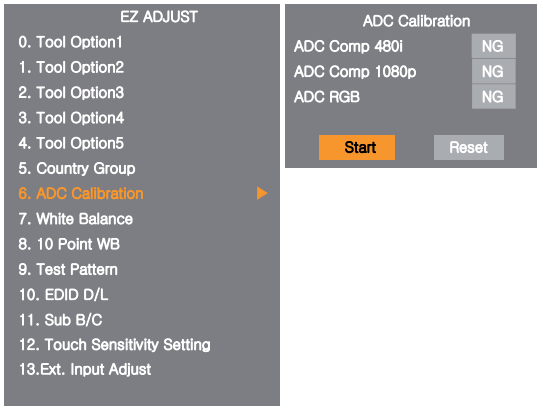
(5) Updating Completed, The TV will restart automatically.
(6) If your TV is turned on, check your updated version and Tool option. (explain the Tool option, next stage)

* If downloading version is more high than your TV have, TV can lost all channel data. In this case, you have to channel recover. if all channel data is cleared, you didn't have a DTV/ ATV test on production line.

* After downloading, have to adjust Tool Option again.
(1) Push "IN-START" key in service remote control.
(2) Select "Tool Option 1" and push "OK" key.
(3) Punch in the number. (Each model has their number)

3.1. ADC Process

(1) ADC
- Enter Service Mode by pushing "ADJ" key,
- Enter Internal ADC mode by pushing "►" key at "6. ADC Calibration".



<Caution> Using "power on" key of the Adjustment remote control, power on TV.

* ADC Calibration Protocol (RS232)

NO	Item	CMD 1	CMD 2	Data 0		
Enter Adjust MODE	Adjust 'Mode In'	A	A	0	0	When transfer the 'Mode In', Carry the command.
ADC adjust	ADC Adjust	A	D	1	0	Automatically adjustment (The use of a internal pattern)

Adjust Sequence
- aa 00 00 [Enter Adjust Mode]
- xb 00 40 [Component1 Input (480i)]
- ad 00 10 [Adjust 480i Comp1]
- xb 00 60 [RGB Input (1024*768)]
- ad 00 10 [Adjust 1024*768 RGB]
- aa 00 90 End Adjust mode

* Required equipment : Adjustment remote control.

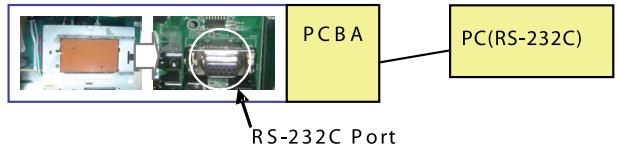
3.2. MAC Address

3.2.1. Equipment & Condition

- Play file: Serial.exe
- MAC Address edit
- Input Start / End MAC address

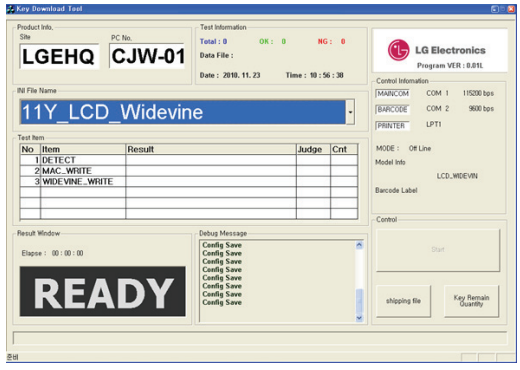
3.2.2. Download method

(1) Communication Prot connection



Connect: PCBA Jig-> RS-232C Port== PC-> RS-232C Port

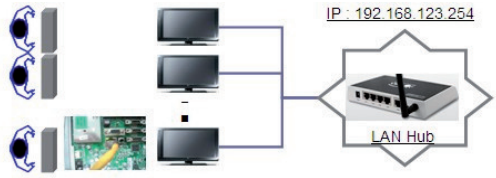
(2) MAC Address Download, Whidevine Download
- Com 1,2,3,4 and 115200(Baud rate)



3.3. LAN Inspection

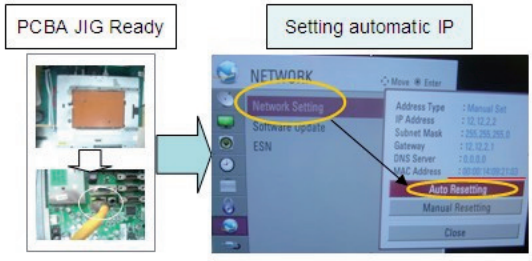
3.3.1. Equipment & Condition

▪ Each other connection to LAN Port of IP Hub and Jig



3.3.2. LAN inspection solution

▪ LAN Port connection with PCB
▪ Network setting at MENU Mode of TV
▪ Setting automatic IP
▪ Setting state confirmation
-> If automatic setting is finished, you confirm IP and MAC Address.



3.4. LAN PORT INSPECTION(PING TEST)

Connect SET -> LAN port == PC -> LAN Port

SET —— PC

3.4.1. Equipment setting

(1) Play the LAN Port Test PROGRAM.
(2) Input IP set up for an inspection to Test Program.
*IP Number : 12.12.2.2

3.4.2. LAN PORT inspection (PING TEST)

(1) Play the LAN Port Test Program.
(2) Connect each other LAN Port Jack.
(3) Play Test (F9) button and confirm OK Message.
(4) Remove LAN cable.

3.5. Function Check

* Check display and sound
- Check Input and Signal items. (cf. work instructions)
1) TV
2) AV
3) COMPONENT (480i)
4) RGB (PC : 1024 x 768 @ 60hz)
5) HDMI
* Display and Sound check is executed by Remote control.

<Caution>
Not to push the INSTOP key after completion if the function inspection.

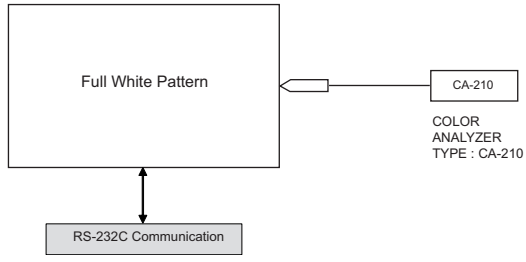
4. Total Assembly line process

4.1. Adjustment Preparation

▪ W/B Equipment condition
CA210
: CCFL/EEFL -> CH9, Test signal: Inner pattern(80IRE)
LED -> CH14, Test signal: Inner pattern(80IRE)
▪ Above 5 minutes H/run in the inner pattern. ("power on" key of Adjustment remote control)(Only EEFL)

Cool	13,000 K	X=0.269 (±0.002) Y=0.273 (±0.002)	<Test Signal> Inner pattern (204gray,80IRE)
Medium	9,300 K	X=0.285 (±0.002) Y=0.293 (±0.002)	
Warm	6,500 K	X=0.313 (±0.002) Y=0.329 (±0.002)	

* Connecting picture of the measuring instrument
(On Automatic control)
Inside PATTERN is used when W/B is controlled. Connect to auto controller or push Adjustment R/C POWER ON -> Enter the mode of White-Balance, the pattern will come out.



*** Auto-control interface and directions**

(1) Adjust in the place where the influx of light like floodlight around is blocked. (illumination is less than 10 lux).
(2) Adhere closely the Color analyzer(CA210) to the module less than 10 cm distance, keep it with the surface of the Module and Color analyzer's prove vertically.(80° ~ 100°).
(3) Aging time
- After aging start, keep the power on (no suspension of power supply) and heat-run over 5 minutes.
- Using 'no signal' or 'POWER ONLY' or the others, check the back light on.

▪ Auto adjustment Map(RS-232C)

RS-232C COMMAND

[CMD ID DATA]

Wb 00 00 White Balance Start

Wb 00 ff White Balance End

	RS-232C COMMAND [CMD ID DATA]			MIN	CENTER (DEFAULT)			MAX
	Cool	Mid	Warm		Cool	Mid	Warm	
R Gain	jg	Ja	jd	00	172	192	192	192
G Gain	jh	Jb	je	00	172	192	192	192
B Gain	ji	Jc	jf	00	192	192	172	192
R Cut					64	64	64	128
G Cut					64	64	64	128
B Cut					64	64	64	128

<Caution>

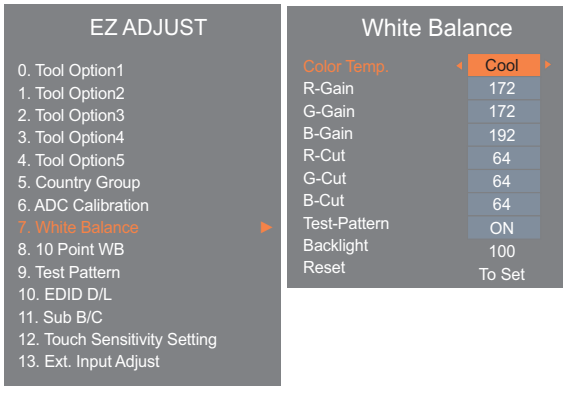
Color Temperature : COOL, Medium, Warm.

One of R Gain/G Gain/ B Gain should be kept on 0xC0, and adjust other two lower than C0.(When R/G/B Gain are all C0, it is the FULL Dynamic Range of Module)

*** Manual W/B process using adjust Remote control.**

▪ After enter Service Mode by pushing "ADJ" key,

▪ Enter White Balance by pushing "►" key at "7. White Balance".



* After you finished all adjustments, Press "In-start" key and compare Tool option and Area option value with its BOM, if it is correctly same then unplug the AC cable. If it is not same, then correct it same with BOM and unplug AC cable. For correct it to the model's module from factory Jig model.

* Push the "IN STOP" key after completing the function inspection.

4.2. EDID DATA

(1) All Data : HEXA Value

(2) Changeable Data :

*: Serial No : Controlled / Data:01

**: Month : Controlled / Data:00

***: Year : Controlled

****: Check sum

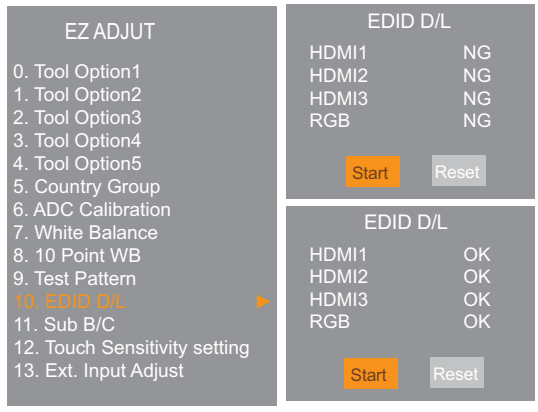
4.2.1. Auto Download

▪ After enter Service Mode by pushing "ADJ" key.

▪ Enter EDID D/L menu.

▪ Enter "START" by pushing "OK" key.

<Caution> Never connect HDMI && D-sub cable when EDID downloaded.



* LS3500, LS4400 and CS460 series have only one HDMI.

* EDID data and Model option download (RS232)

NO	Item	CMD 1	CMD 2	Data 0		
Enter download MODE	Download 'Mode In'	A	A	0	0	When transfer the 'Mode In', Carry the command.
EDID data and Model option download	Download	A	E	00	10	Automatically download (The use of a internal data)

No.	Item	Condition	Hex Data
1	Manufacturer ID	GSM	1E6D
2	Version	Digital : 1	01
3	Revision	Digital : 3	03

(1) HD RGB EDID data

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	ff	ff	ff	ff	ff	ff	0	1e	6d	a		b			
10	c		01	03	68	10	9	78	0a	ee	91	a3	54	4c	99	26
20	0f	50	54	a1	8	0	81	c0	61	40	45	40	31	40	1	1
30	1	1	1	1	1	1	1b	21	50	a0	51	0	1e	30	48	88
40	35	0	a0	5a	0	0	0	1e	1	1d	0	72	51	d0	1e	20
50	6e	28	55	0	a0	5a	0	0	0	1e	0	0	0	fd	0	3a
60	3e	1f	46	10	0	0a	20	20	20	20	20	20	d			
70	d														00	e

(2) HD HDMI EDID data

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	ff	ff	ff	ff	ff	ff	00	1E	6D	a		b			
10	c		01	03	80	A0	5A	78	0A	EE	91	A3	54	4C	99	26
20	0F	50	54	A1	08	00	31	40	45	40	61	40	71	40	01	01
30	01	01	01	01	01	01	66	21	50	B0	51	00	1B	30	40	70
40	36	00	40	84	63	00	00	1E	64	19	00	40	40	00	26	30
50	18	88	03	06	40	84	63	00	00	18	00	00	00	FD	00	3A
60	3E	1E	53	10	00	0A	20	20	20	20	20	20	d			
70	d														01	e
80	02	03	22	F1	4E	10	1F	84	13	05	14	03	02	12	20	21
90	22	15	01	26	15	07	50	09	57	07	f					
A0	80	1E	01	1D	80	18	71	1C	16	20	58	2C	25	00	A0	5A
B0	00	00	00	9E	01	1d	00	80	51	D0	0c	20	40	80	35	00
C0	A0	5A	00	00	00	1E	8C	0A	D0	8A	20	E0	2D	10	10	3E
D0	96	00	A0	5A	00	00	00	18	02	3A	80	18	71	38	2D	40
E0	58	2C	45	00	A0	5A	00	00	00	1E	00	00	00	00	00	00
F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	e

(3) Detail EDID Options are below

a. Product ID

MODEL NAME	HEX	EDID Table	DDC Function
HD/FHD Model	0001	01 00	Analog/Digital

b. Serial No: Controlled on production line.

c. Month, Year: Controlled on production line:

ex) Week : '01' -> '01'

Year : '2012' -> '16' fix

d. Model Name(Hex):

MODEL NAME	MODEL NAME(HEX)
LG TV	00 00 00 FC 00 4C 47 20 54 56 0A 20 20 20 20 20 20 20 20 (LG TV)

cf) TV set's model name in EDID data is below.

e. Checksum: Changeable by total EDID data.

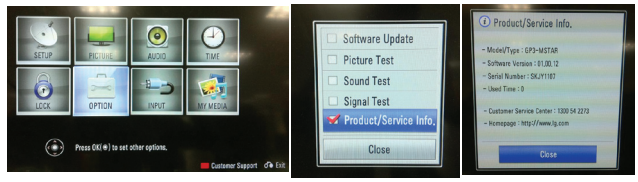
EDID C/S data		HD	
		HDMI	RGB
Check sum (Hex)	Block 0	A4	5C
	Block 1	6E (HDMI1)	-
		5E (HDMI2)	
		4E (HDMI3)	

f. Vendor Specific(HDMI)

Input	Model name(HEX)
HDMI1	67030C001000
HDMI2	67030C002000
HDMI3	67030C003000

4.3. Model name & Serial number D/L

- Press "Power on" key of service remote control. (Baud rate : 115200 bps)
- Connect RS232 Signal Cable to RS-232 Jack.
- Write Serial number by use RS-232.
- Must check the serial number at the Product/Service info.. (menu key -> red key -> select product/Service info)



4.3.1. Signal Table

START	6E	A	50	A	LEN	A	03	A	CMD	A	00	A	VAL	A	CS	STOP

CMD : A0h
LENGTH : 85~94h (1~16 bytes)
ADH : EEPROM Sub Address high (00~1F)
ADL : EEPROM Sub Address low (00~FF)
Data : Write data
CS : CMD + LENGTH + ADH + ADL + Data_1 +...+ Data_n
Delay : 20ms

4.3.2. Comand Set

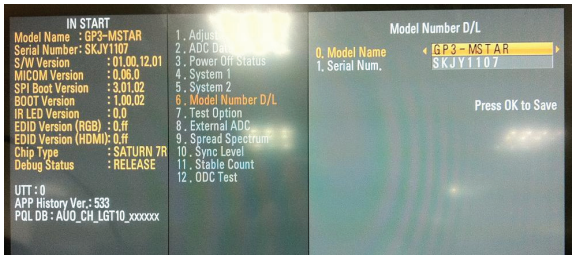
Adjust mode	CMD(hex)	LENGTH(hex)	Description
EEPROM WRITE	A0h	84h+n	n-bytes Write (n = 1~16)

* Description
FOS Default write : <7mode data> write
Vtotal, V_Frequency, Sync_Polarity, Htotal, Hstart, Vstart, 0, Phase
Data write : Model Name and Serial Number write in EEPROM,.

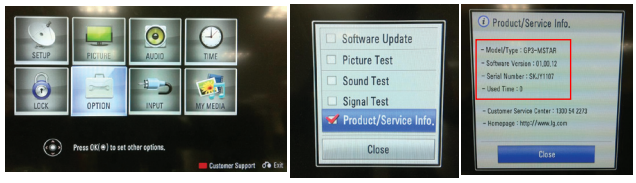
4.3.3. Method & notice

(1) Serial number D/L is using of scan equipment.
(2) Setting of scan equipment operated by Manufacturing Technology Group.
(3) Serial number D/L must be conformed when it is produced in production line, because serial number D/L is mandatory by D-book 4.0.

* Manual Download(Model Name and Serial Number)
If the TV set is downloaded by OTA or Service man, sometimes model name or serial number is initialized.(Not always)
There is impossible to download by bar code scan, so It need Manual download.
1) Press the "Instart" key of Adjustment remote control.
2) Go to the menu "6.Model Number D/L" like below photo.
3) Input the Factory model name or Serial number like photo.



4) Check the model name Instart menu. → Factory name displayed.
5) Check the Product/Service info..(Menu key → Red key → Select product/Service info) → Buyer model displayed.



4.3.4. Outgoing condition Configuration

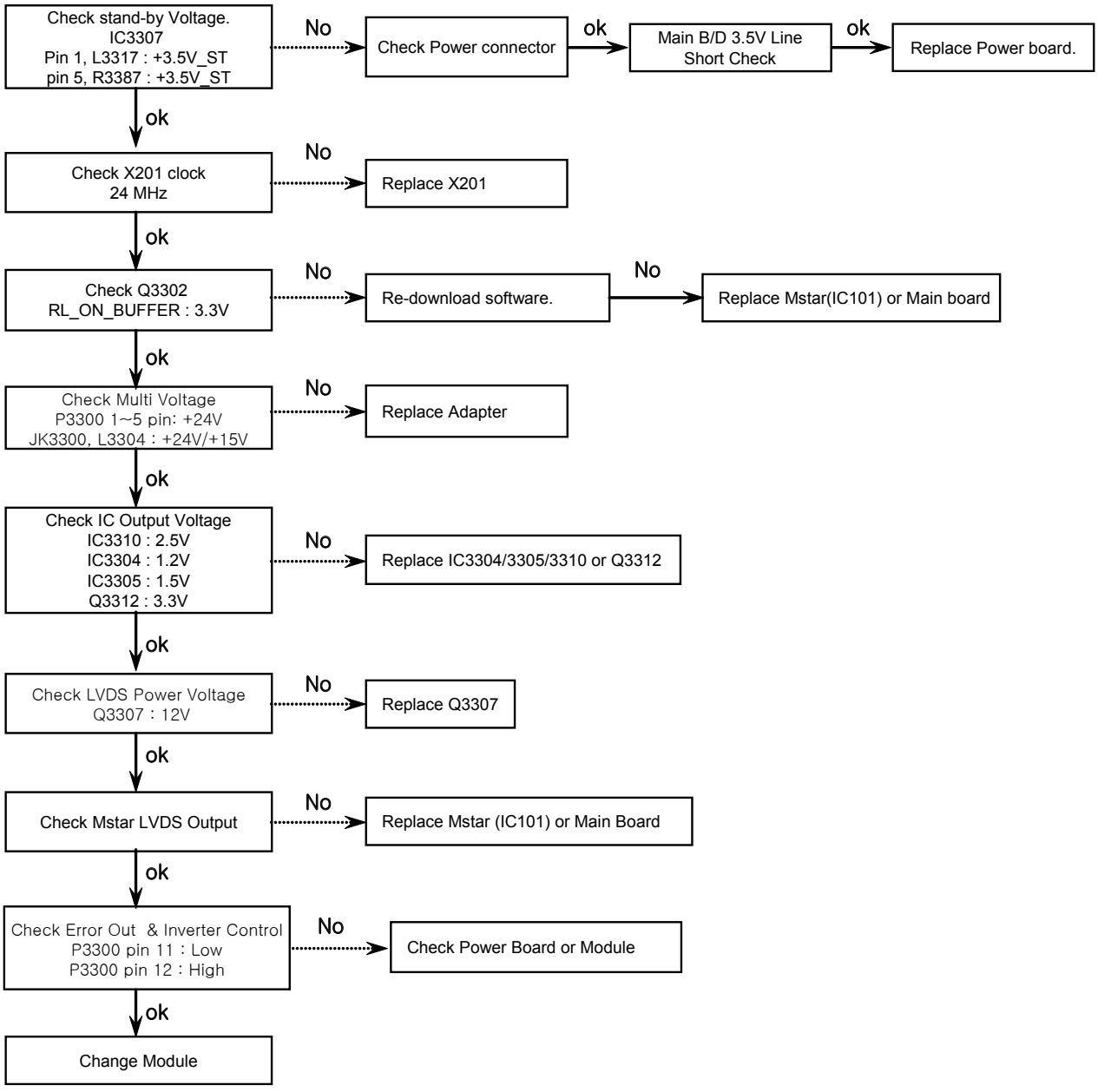
■ When pressing IN-STOP key by SVC remocon, Red LED are blinked alternatively. And then automatically turn off. (Must not AC power OFF during blinking)

4.4 Hi-Pot Test

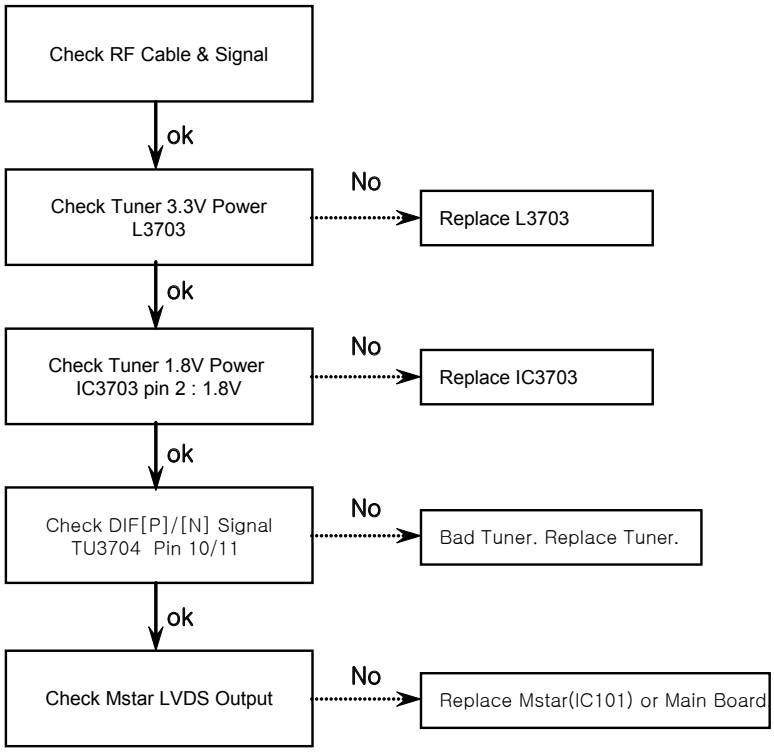
Confirm whether is normal or not when between power board's ac block and GND is impacted on 1.5 kV(dc) or 2.2 kV(dc) for one second.

TROUBLE SHOOTING

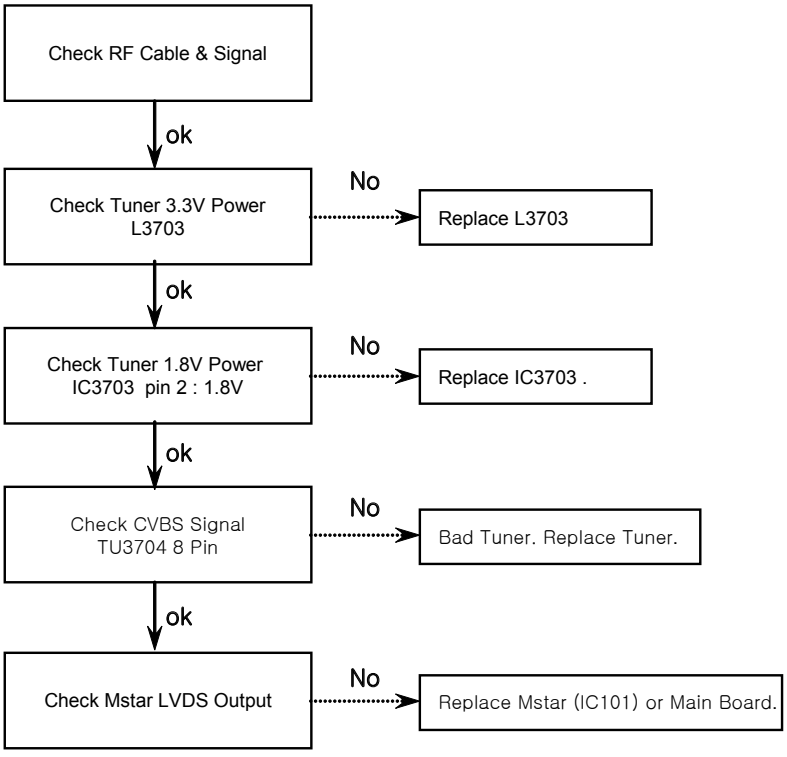
1. Power-up boot check



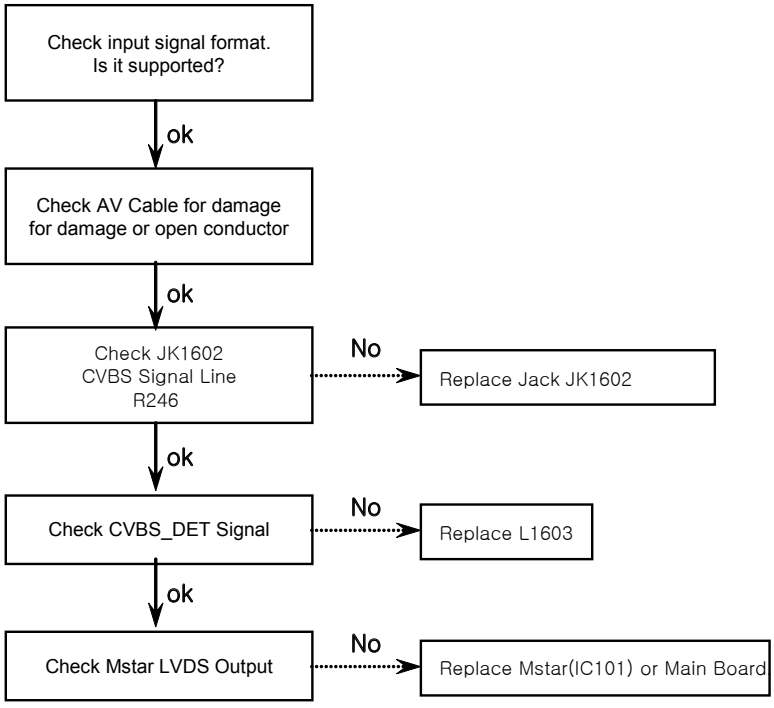
2. Digital TV Video



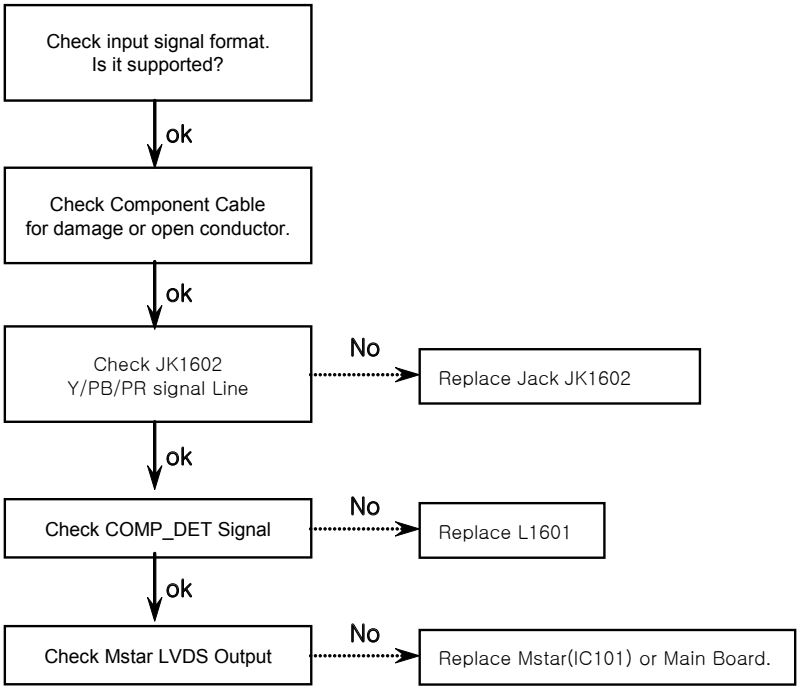
3. Analog TV Video



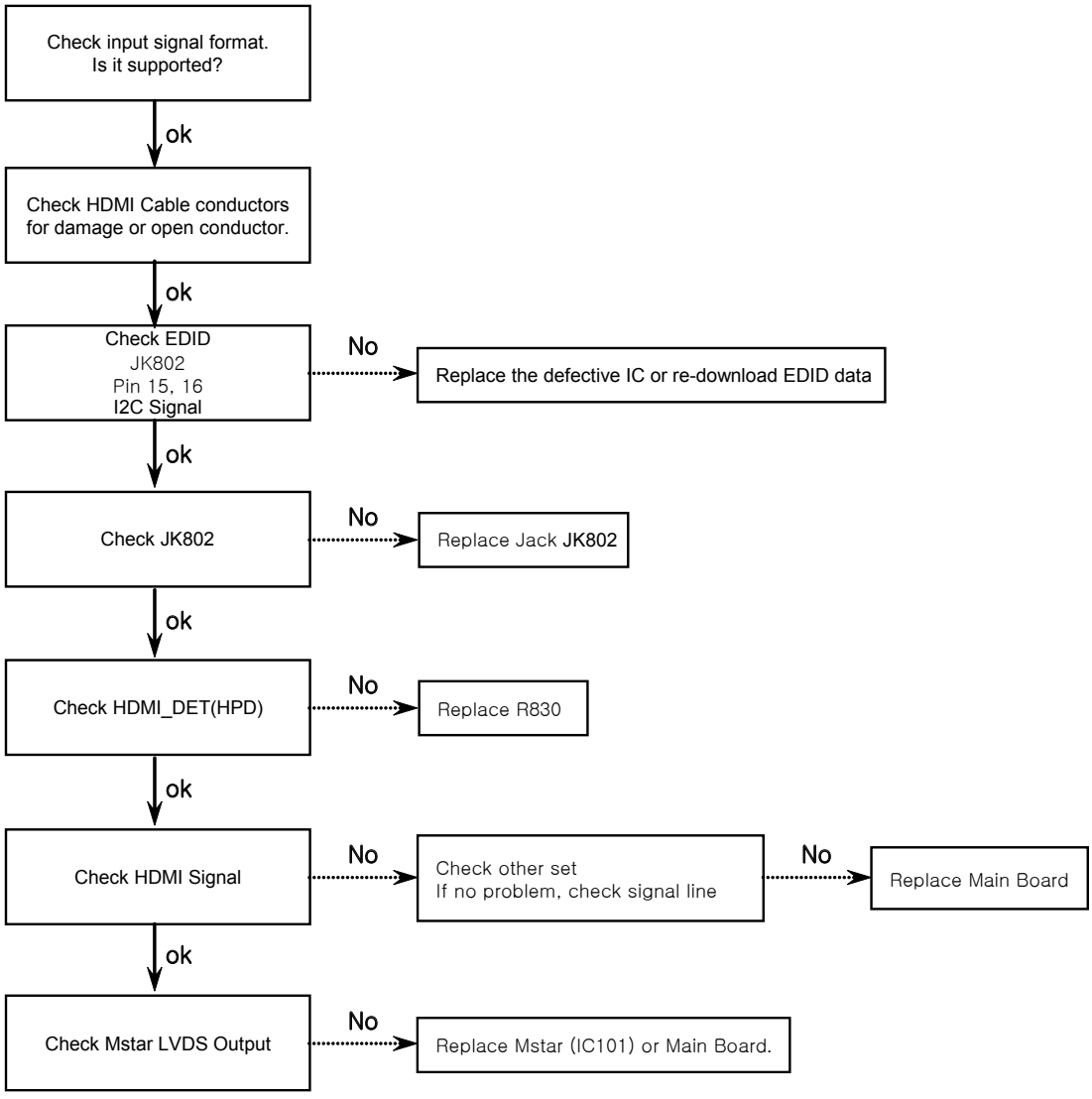
4. AV Video



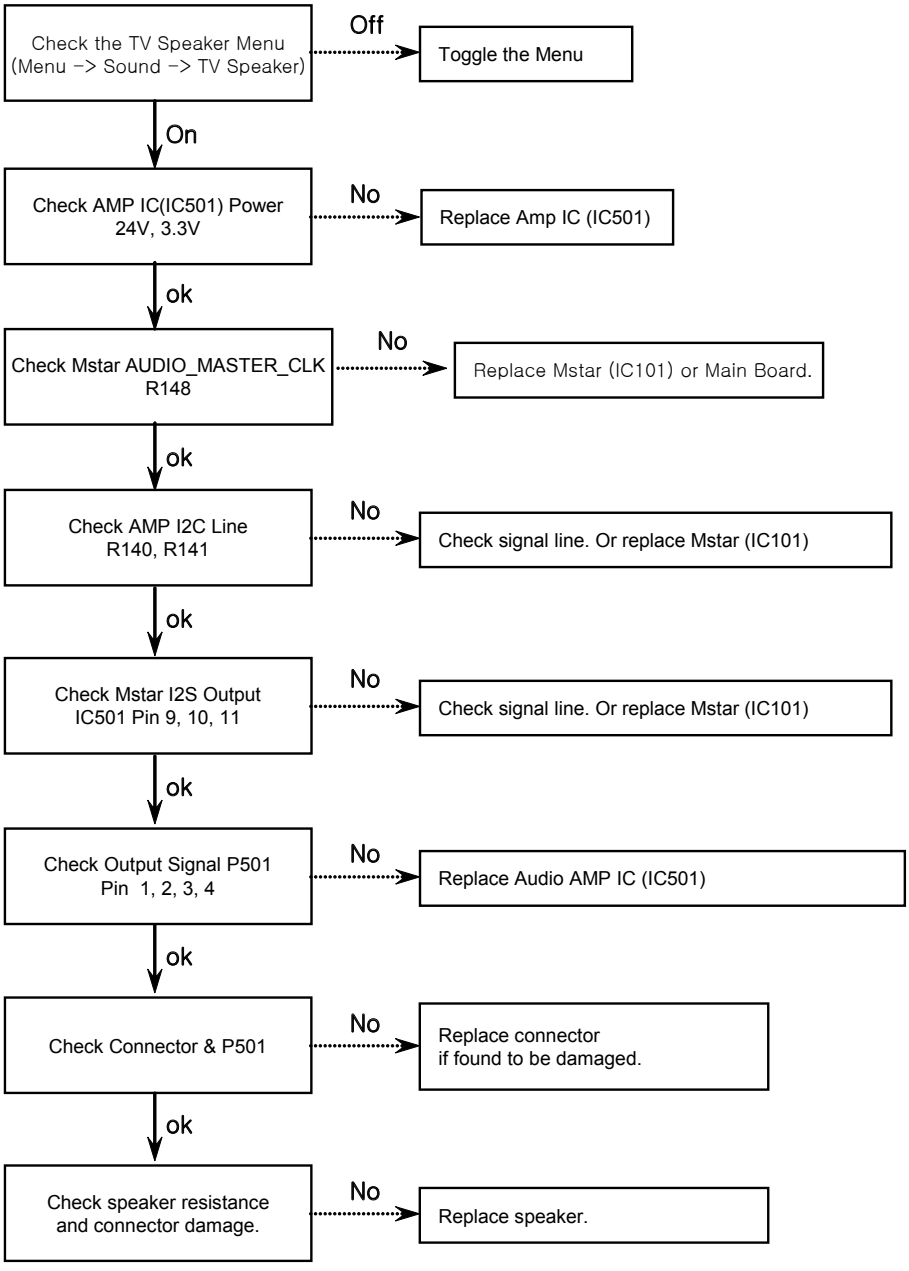
5. Component Video



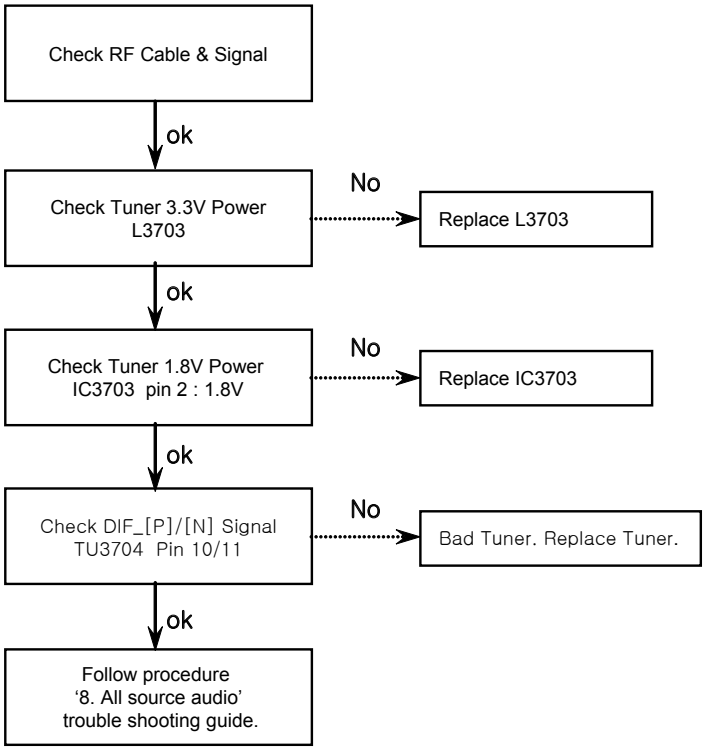
6. HDMI Video



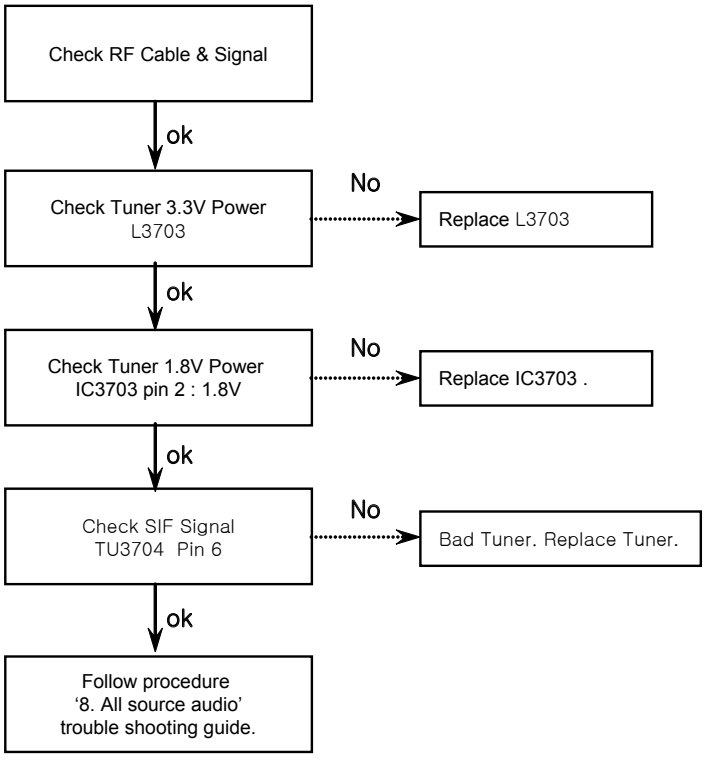
7. All Source Audio



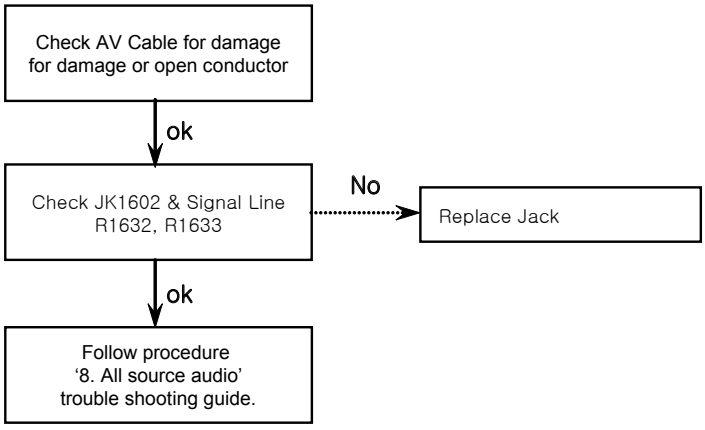
8. Digital TV Audio



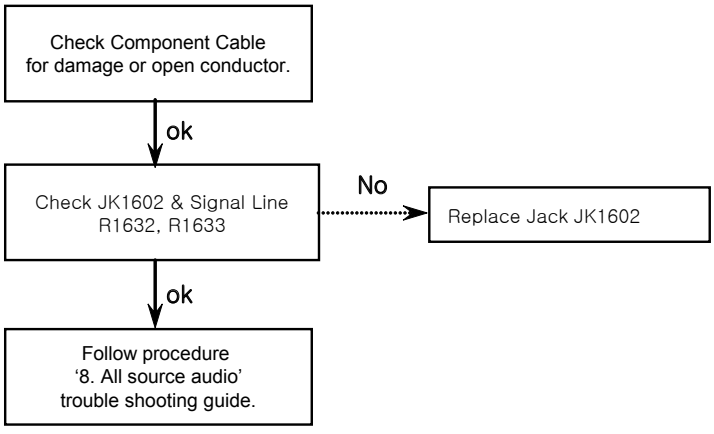
9. Analog TV Audio



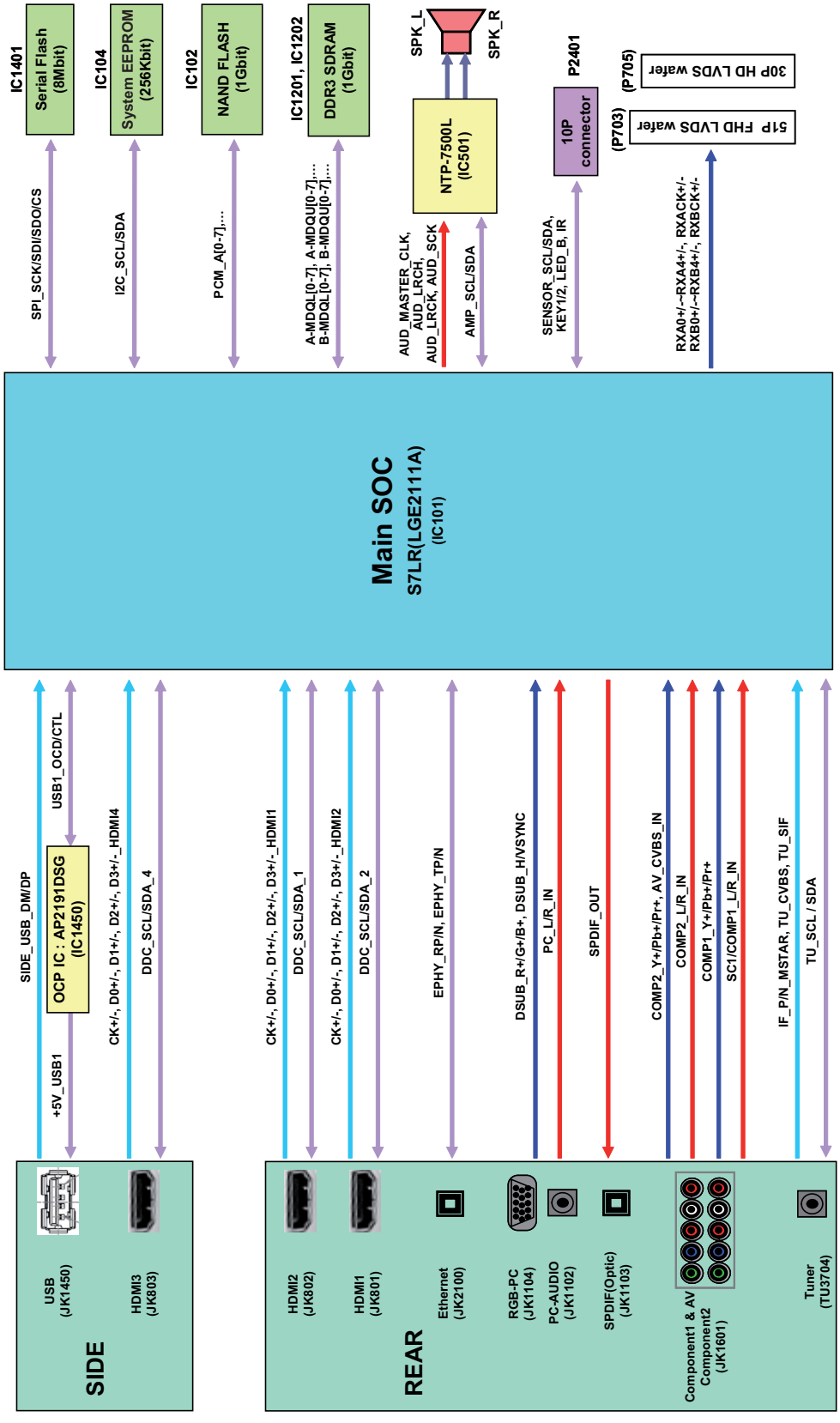
10. AV Audio



11. Component Audio



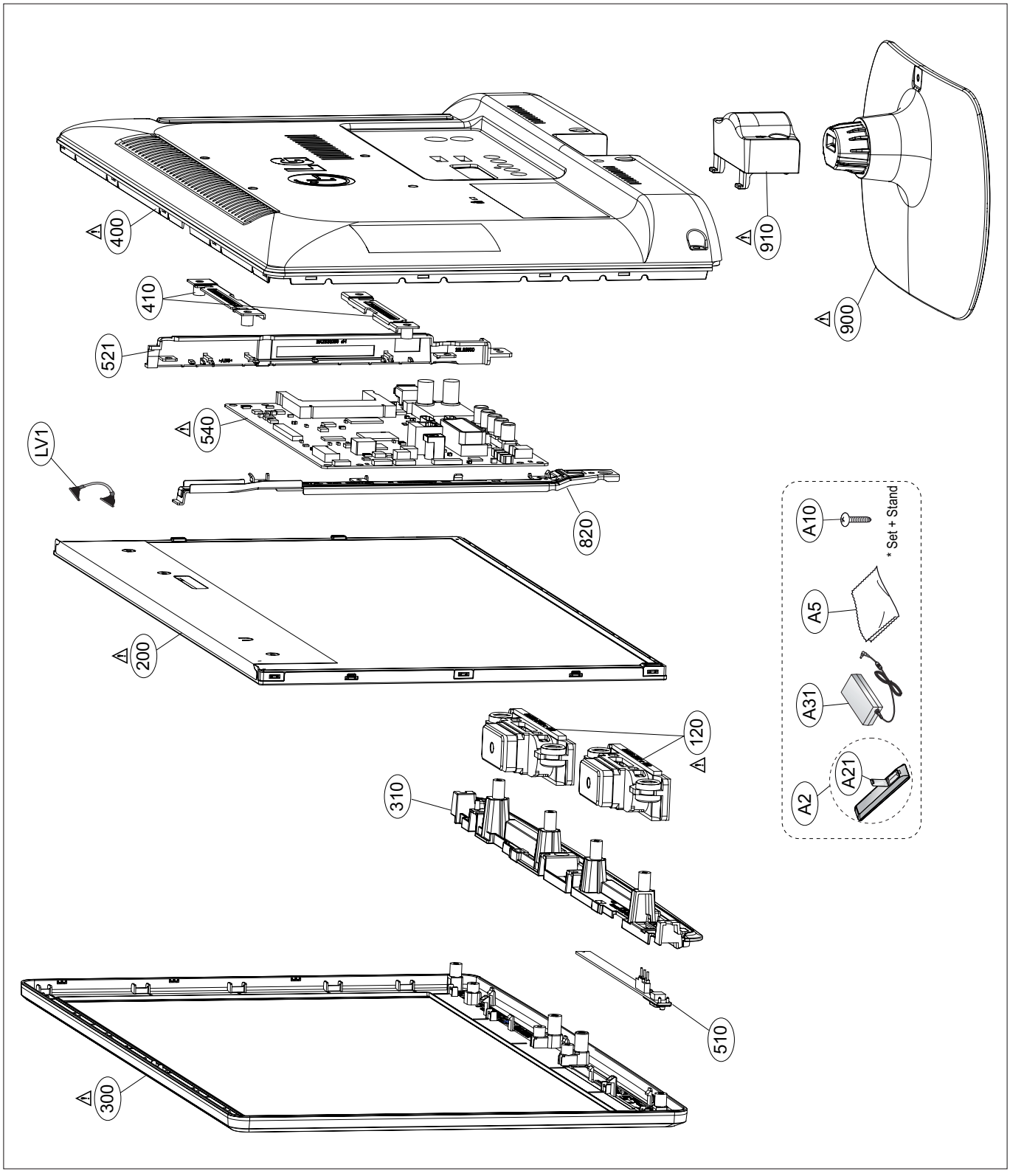
BLOCK DIAGRAM



EXPLODED VIEW

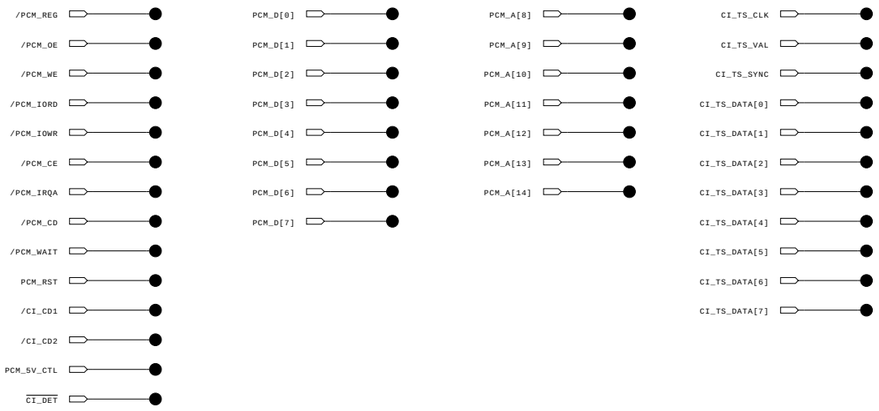
IMPORTANT SAFETY NOTICE

Many electrical and mechanical parts in this chassis have special safety-related characteristics. These parts are identified by ⚠ in the Schematic Diagram and EXPLODED VIEW.
It is essential that these special safety parts should be replaced with the same components as recommended in this manual to prevent X-RADIATION, Shock, Fire, or other Hazards.
Do not modify the original design without permission of manufacturer.

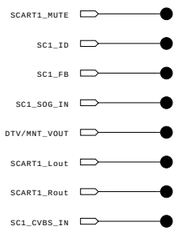


TP for NON-EU models(except EU and China)

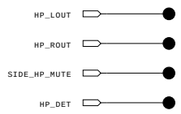
TP for CI slot



TP for SCART



TP for Headphone



TP for S2

THE ⚠ SYMBOL MARK OF THIS SCHEMETIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION. FILRE AND ELECTRICAL SHOCK HAZARDS, WHEN SERVICING IF IS ESSENTIAL THAT ONLY MANUFATURES SPECFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE ⚠ SYMBOL MARK OF THE SCHEMETIC.

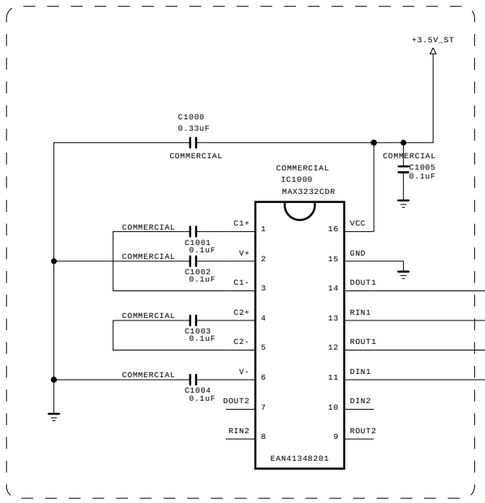
SECRET
LGElectronics

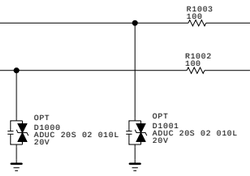
LG ELECTRONICS

MODEL	GP4_S7LR2	DATE	2011.07.07
BLOCK	TP_NON_EN	SHEET	3 /

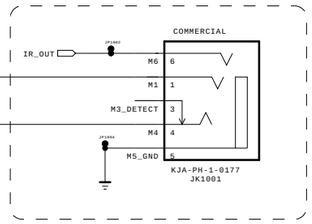
RS-232C

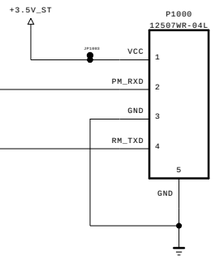
COMMERCIAL MODEL OPTION





COMMERCIAL MODEL OPTION



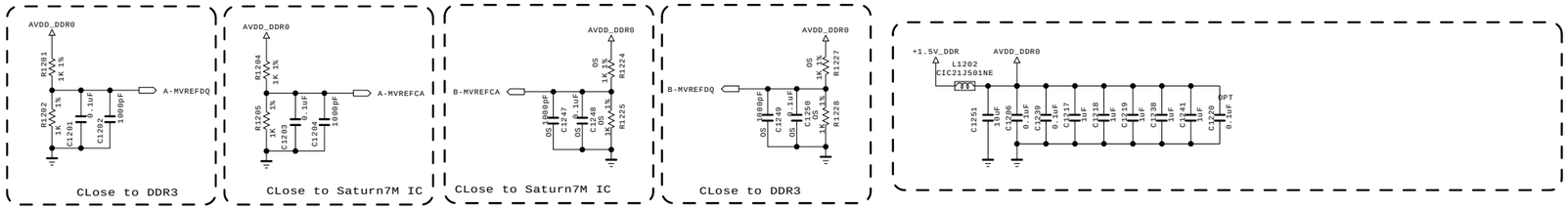


For Comsumer model,
use 4PIN Wafer.

SECRET
LGElectronics

LG ELECTRONICS

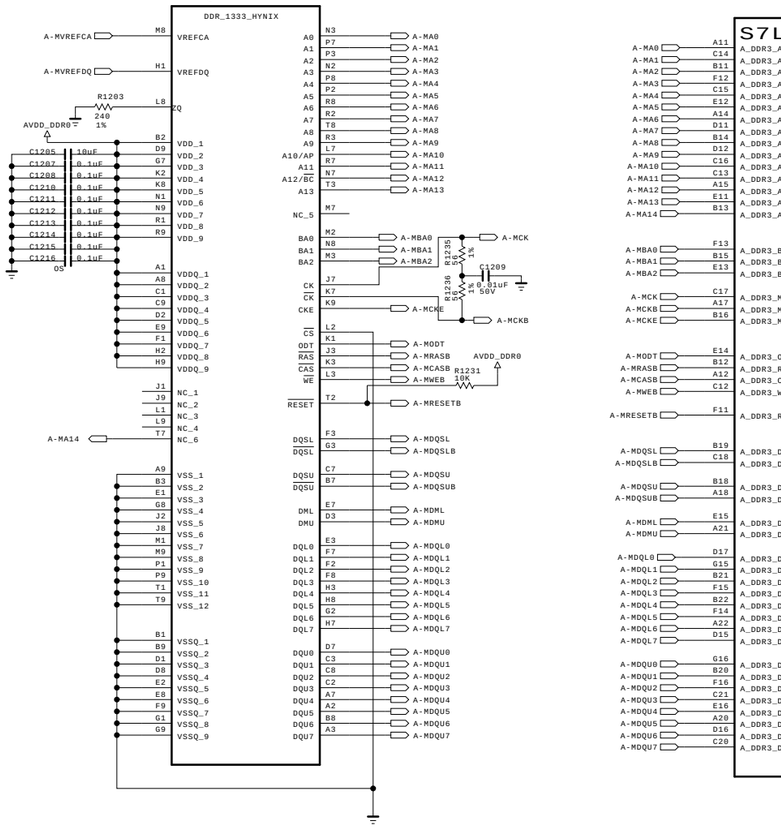
MODEL	GP4L_S7LR2	DATE	2011/08/13
BLOCK	RS232C_PHONE	SHEET	10 /



EAN61828901

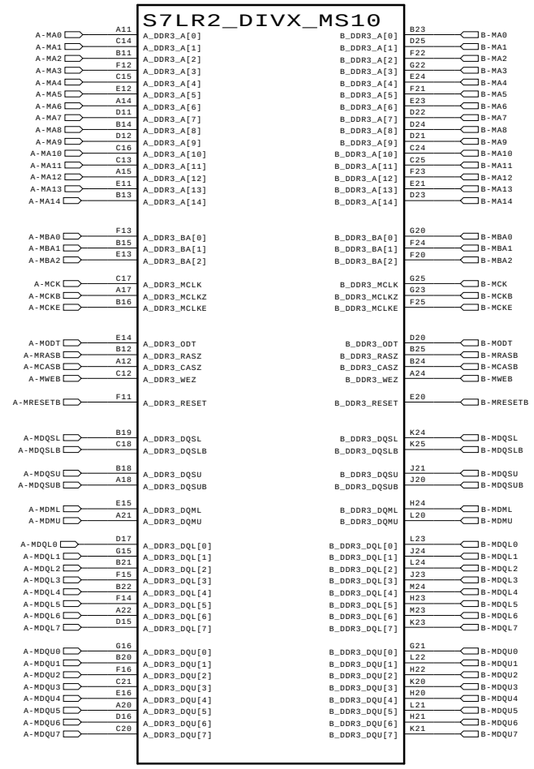
IC1201 H5TQ1G63DFR-H9C

DDR_1333_HYNIX



IC101 LGE2111A-T8

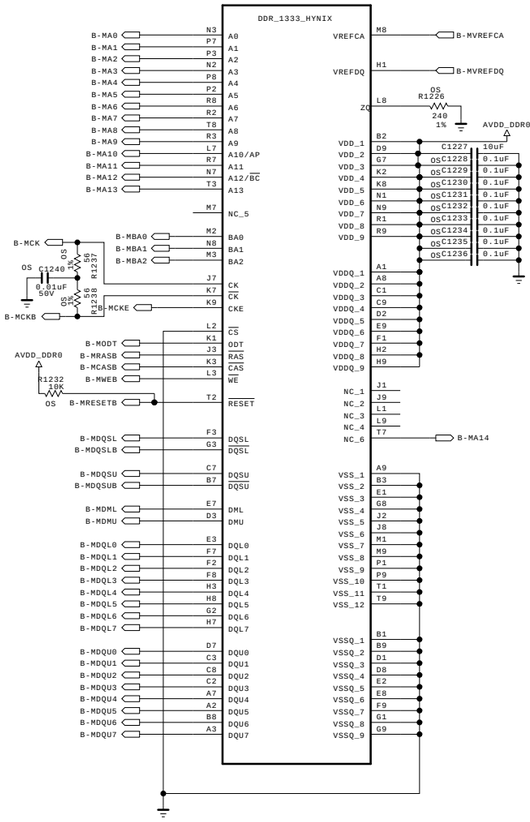
S7LR2_DIVX_MS10



EAN61828901

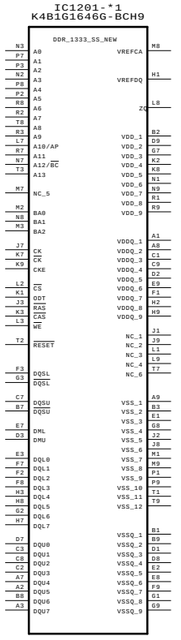
IC1202 H5TQ1G63DFR-H9C

DDR_1333_HYNIX



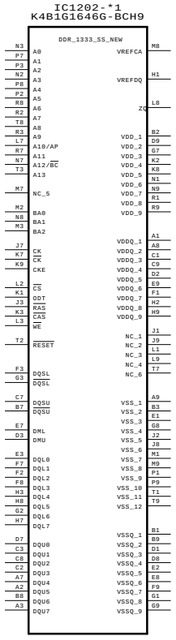
IC1201-*1 K4B1G1646G-BCH9

DDR_1333_SS_NEW



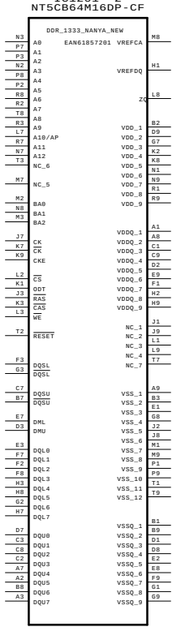
IC1202-*1 K4B1G1646G-BCH9

DDR_1333_SS_NEW



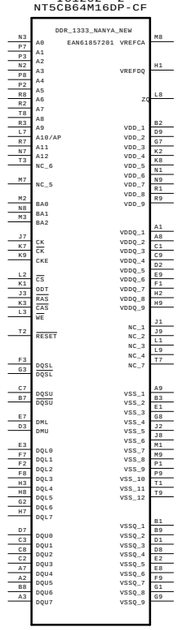
IC1201-*2 NT5CB64M16DP-CF

DDR_1333_NANYA_NEW



IC1202-*2 NT5CB64M16DP-CF

DDR_1333_NANYA_NEW



DDR_1600_SS IC1201-*A K4B1G1646G-BCK0

DDR_1600_SS IC1201-*B K4B1G1646G-BCK0

DDR_1600_HYNIX IC1201-*C H5TQ1G63DFR-PBC

DDR_1600_HYNIX IC1201-*D H5TQ1G63DFR-PBC

DDR_DVB_T2_2G IC1201-*E K4B2G1646C

DDR_DVB_T2_2G IC1201-*F K4B2G1646C

DDR_1600_MICRON IC1201-*G MT41J64M16JT-125:G

DDR_1600_MICRON IC1202-*G MT41J64M16JT-125:G

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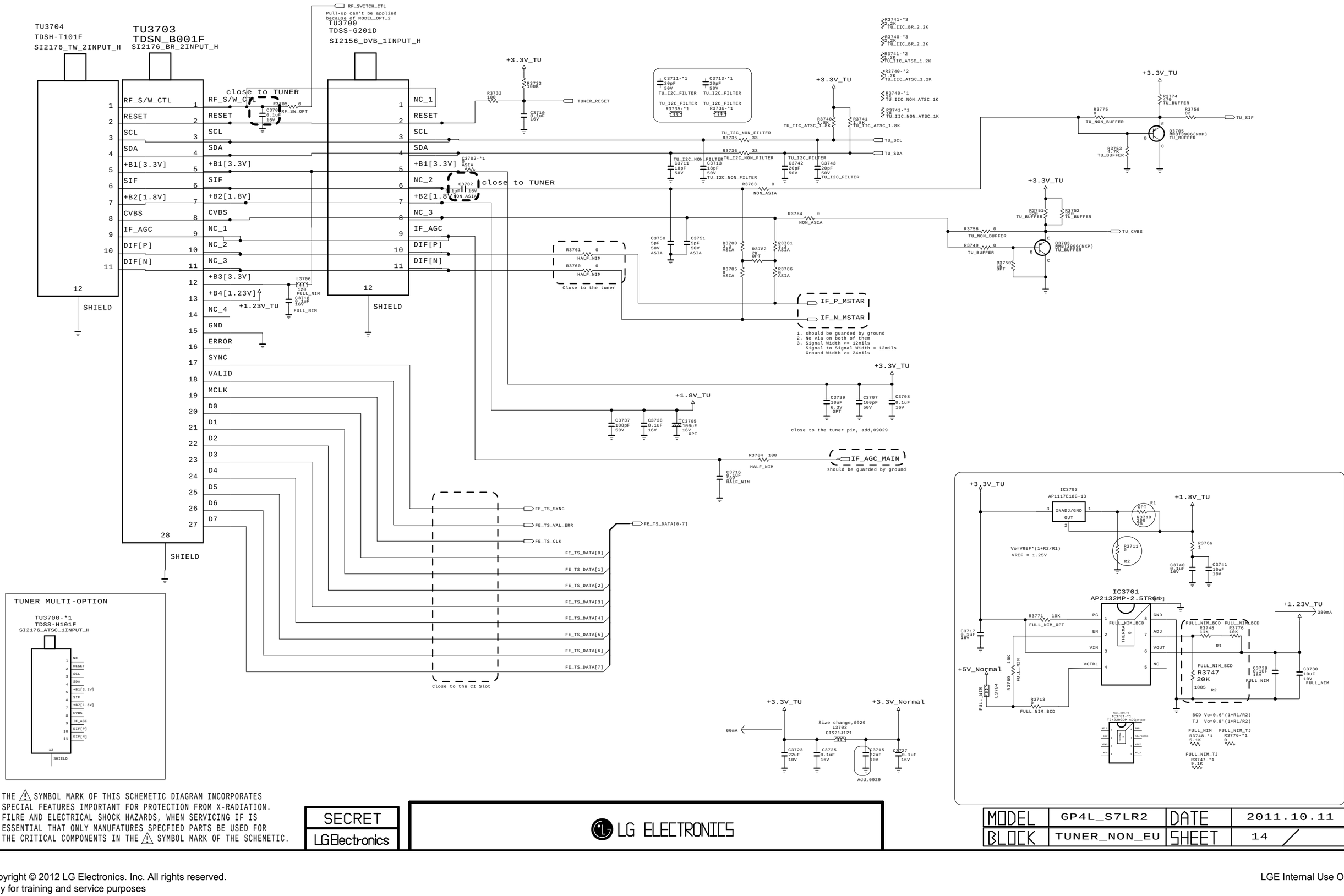
LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011/06/03
BLOCK	DDR_256	SHEET	12 /

GLOBAL tuner block except EU and China



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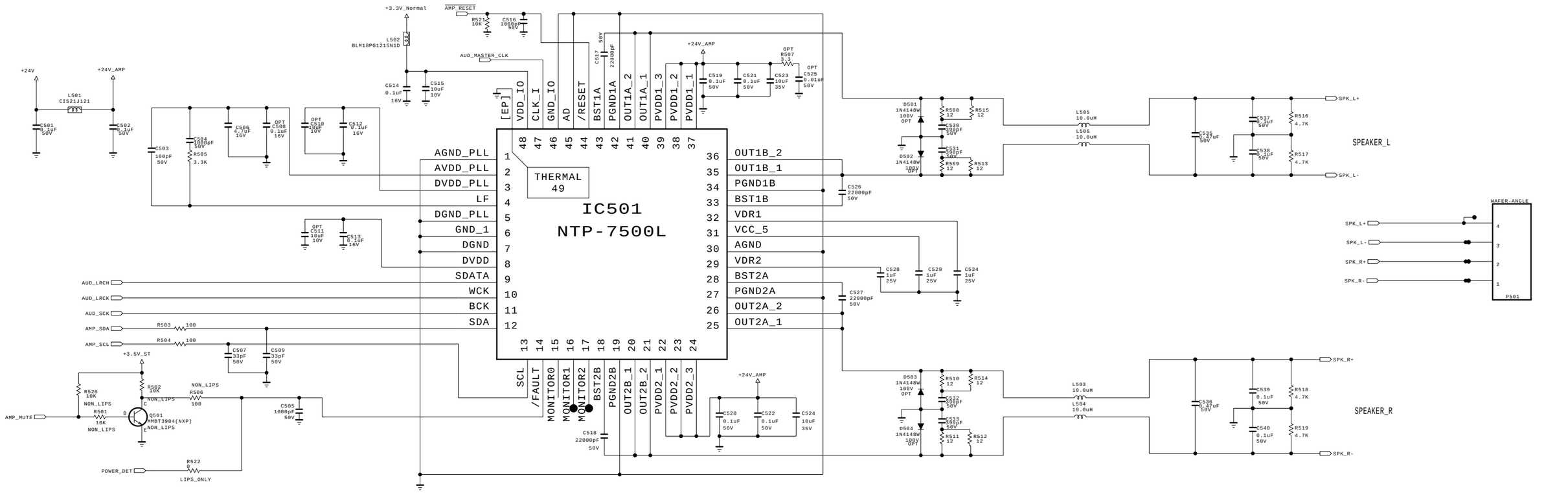
LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011.10.11
BLOCK	TUNER_NON_EU	SHEET	14

Audio amp(NTP-7500)



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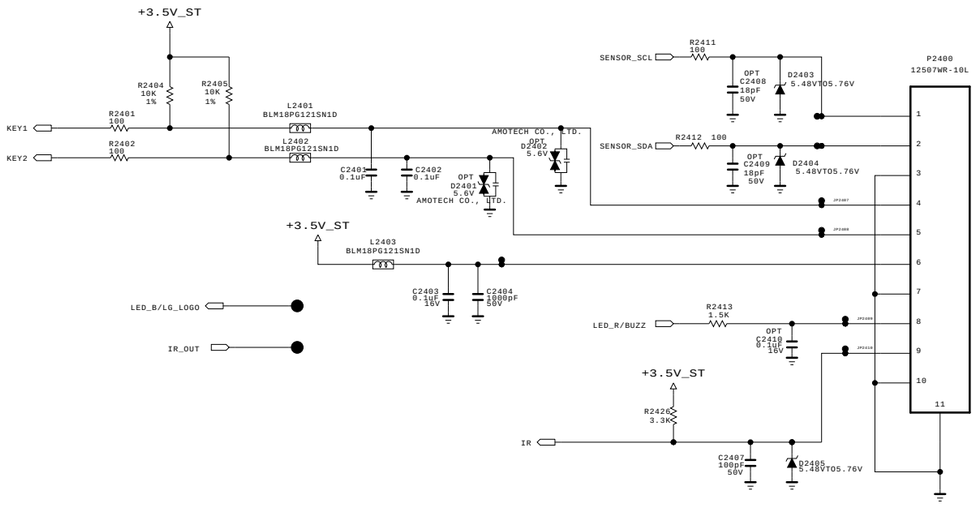
LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011.10.04
BLOCK	NTP-7500	SHEET	16 /

IR/LED and control for on.y ’12 sub without IR-OUT.



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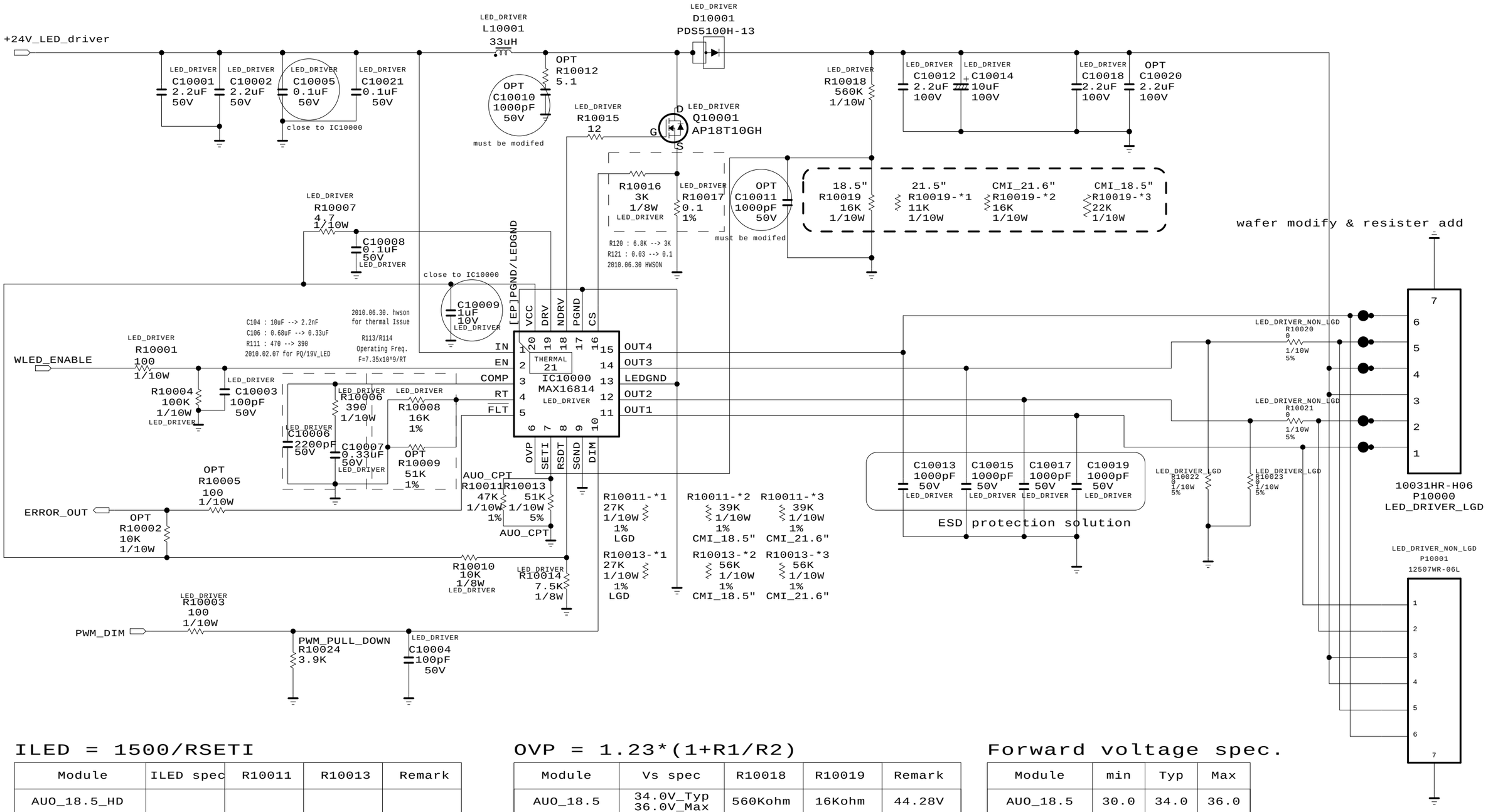
LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011/08/17
BLOCK	IR/CONTROL_W/O_IR_OUT	SHEET	23

LED driver circuit for TN module



ILED = 1500/RSETI

Module	ILED spec	R10011	R10013	Remark
AUO_18.5_HD	60mA_Typ 63mA_Max	47Kohm	51Kohm	61.35mA
AUO_21.5_FHD				
CPT_21.5_FHD				
LGD_21.5_FHD	110mA_Typ 120mA_Max	27Kohm	27Kohm	111.11mA
CMI_18.51_HD	65mA_Typ 70mA_Max	39Kohm	56Kohm	65.24mA
CMI_21.6_FHD	65mA_Typ 70mA_Max	39Kohm	56Kohm	65.24mA

OVP = 1.23*(1+R1/R2)

Module	Vs spec	R10018	R10019	Remark
AUO_18.5	34.0V_Typ 36.0V_Max	560Kohm	16Kohm	44.28V
AUO_21.5	52.8V_Typ 57.6V_Max	560Kohm	11Kohm	63.85V
CPT_21.5	52.0V_Typ 57.6V_Max	560Kohm	11Kohm	63.85V
LGD_21.5	51.2V_Typ 56.0V_Max	560Kohm	11Kohm	63.85V
CMI_18.51	24.8V_Typ 27.2V_Max	560Kohm	22Kohm	32.54V
CMI_21.6	37.8V_Typ 40.8V_Max	560Kohm	16Kohm	44.28V

Forward voltage spec.

Module	min	Typ	Max
AUO_18.5	30.0	34.0	36.0
AUO_21.5	48.0	52.8	57.6
CPT_21.5	46.4	52.0	57.6
LGD_21.5	-	51.2	56.0
CMI_18.51	-	24.8	27.2
CMI_21.6	33.6	37.8	40.8

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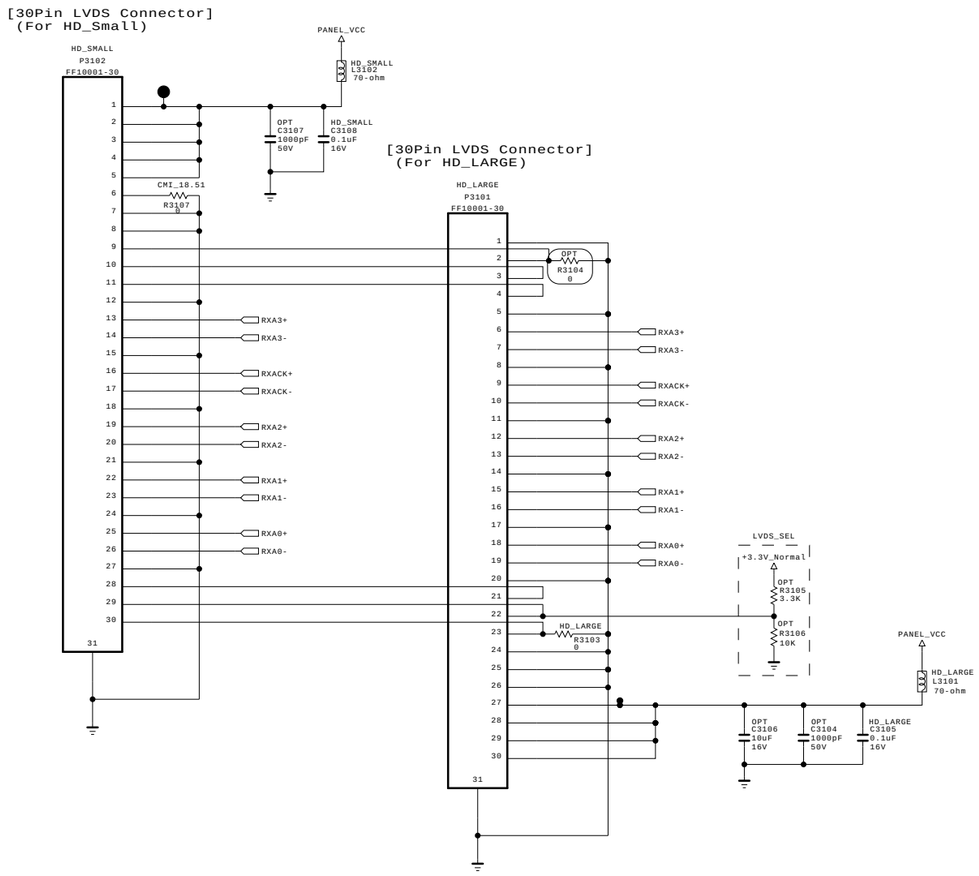
LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011/08/19
BLOCK	SMALL_TN_LED_DRIVER	SHEET	29

LVDS_SMALL



RXA4+
RXA4-
RXB4+
RXB4-
RXB3+
RXB3-
RXBCK+
RXBCK-
RXB2+
RXB2-
RXB1+
RXB1-
RXB0+
RXB0-

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SECRET
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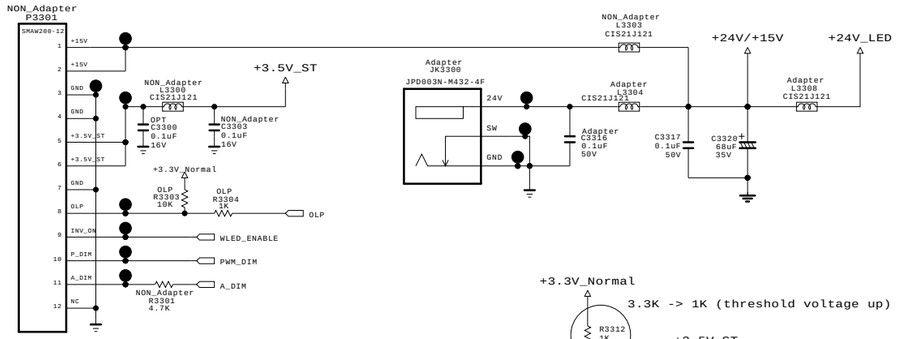
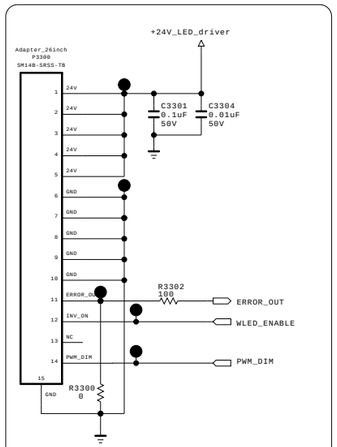
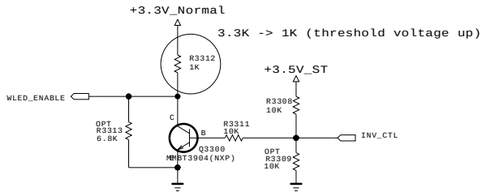
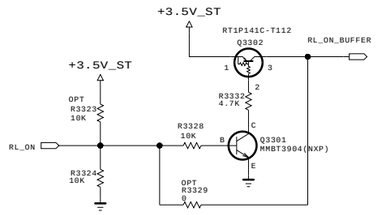
LG ELECTRONICS

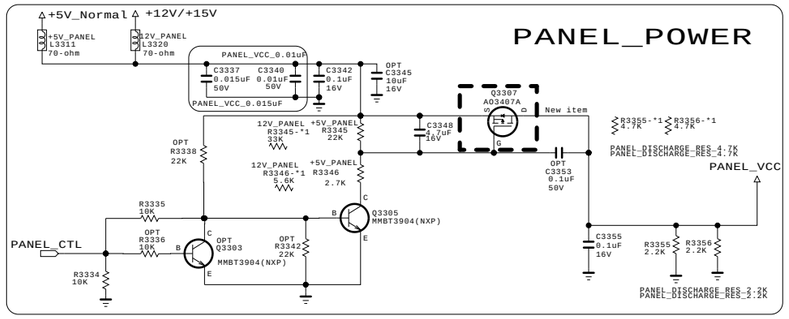
MODEL	GP4L_S7LR2	DATE	2011/09/27
BLOCK	SMALL_LVDS	SHEET	31

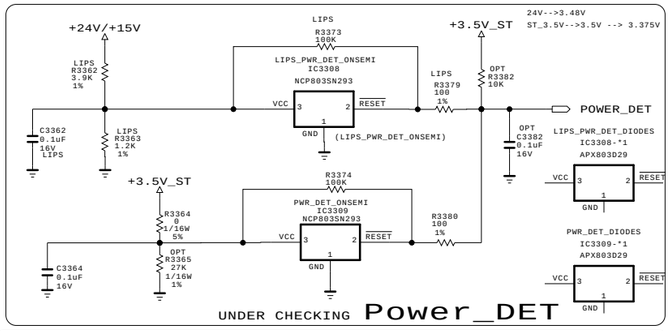


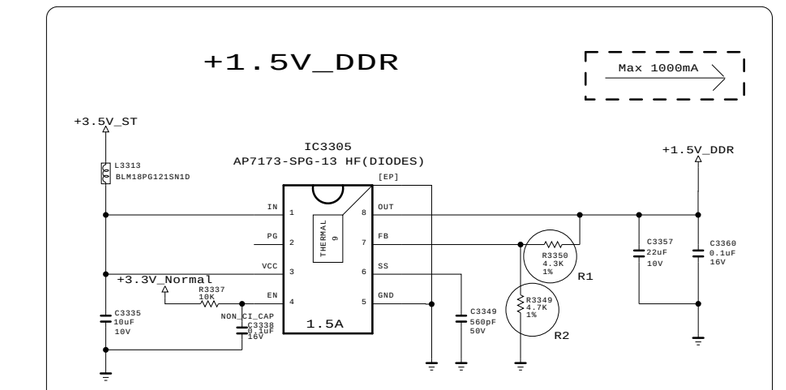


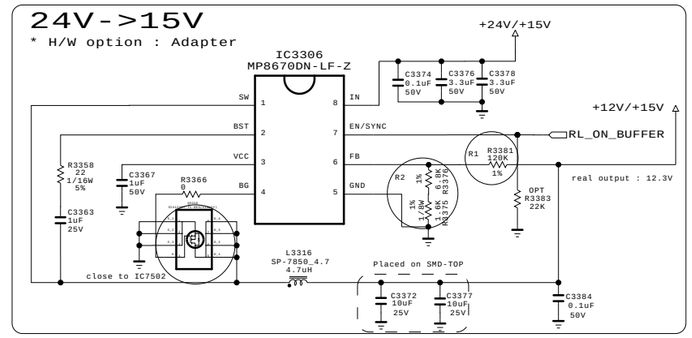


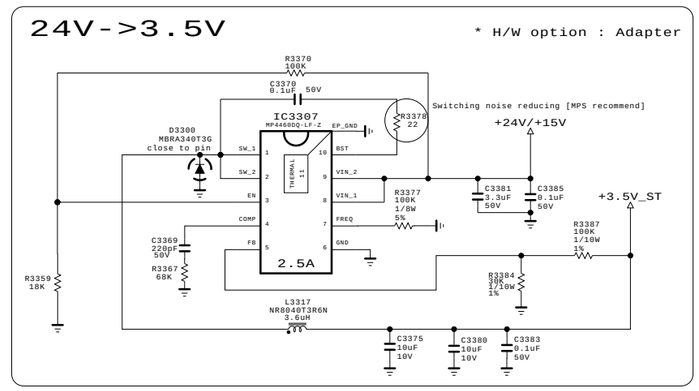


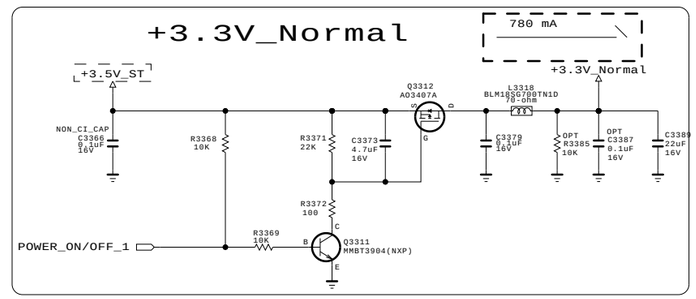


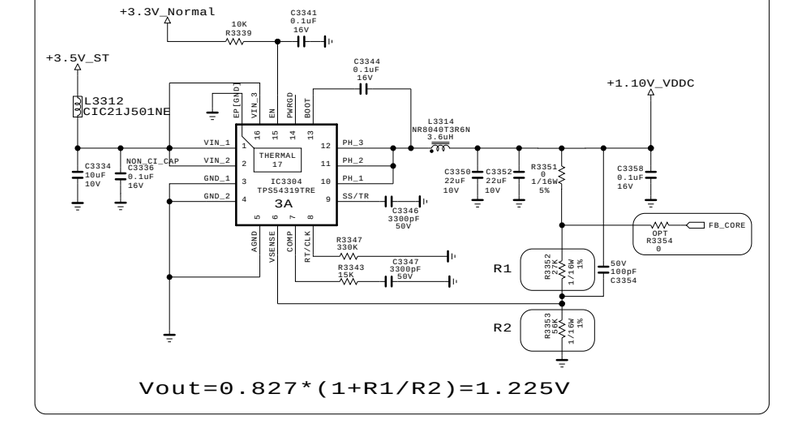


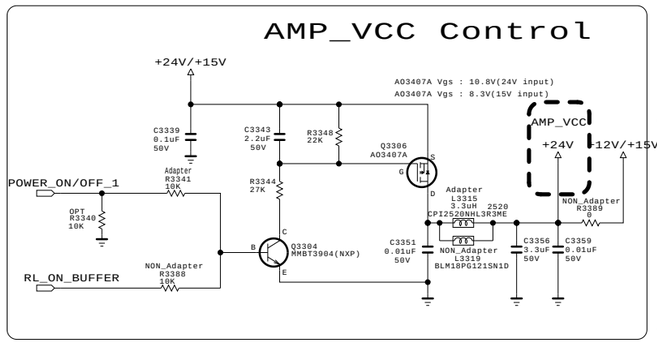


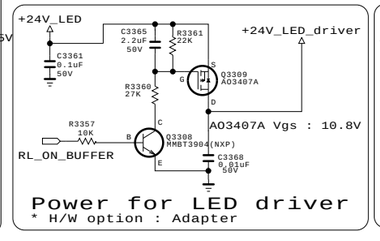


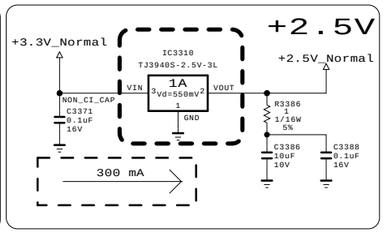


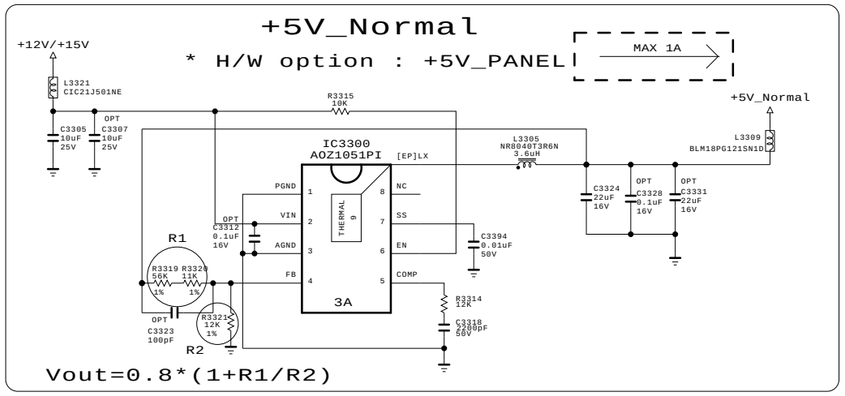


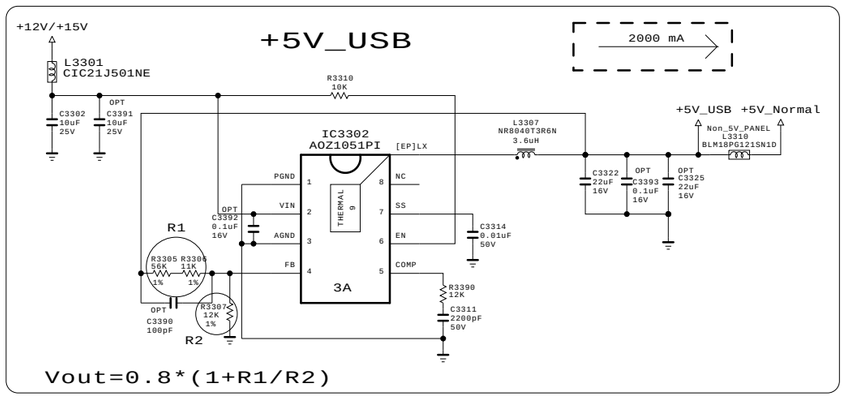












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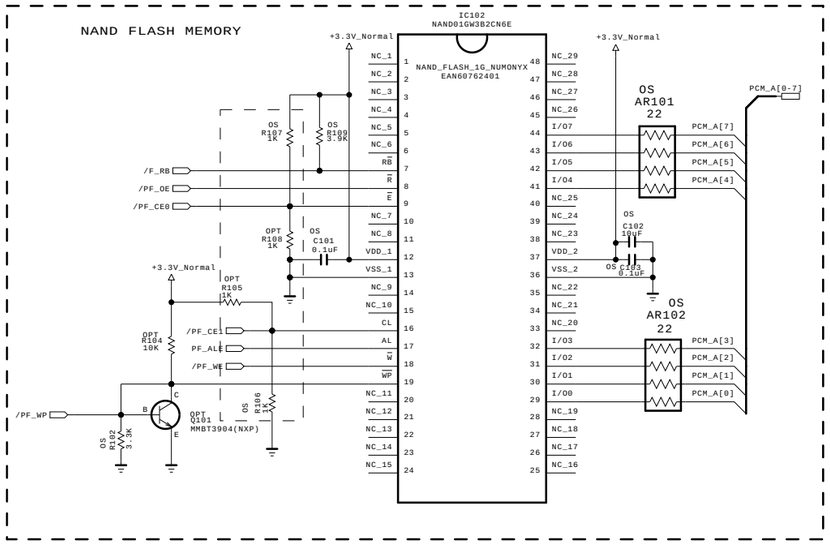
SECRET
LGElectronics

LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011/10/10
BLOCK	SMALL_POWER	SHEET	33

NAND FLASH MEMORY

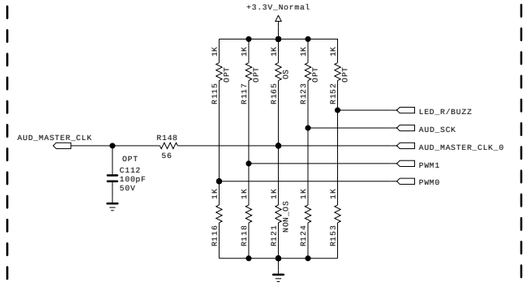


<CHIP Config(LED_R/BUZZ)>

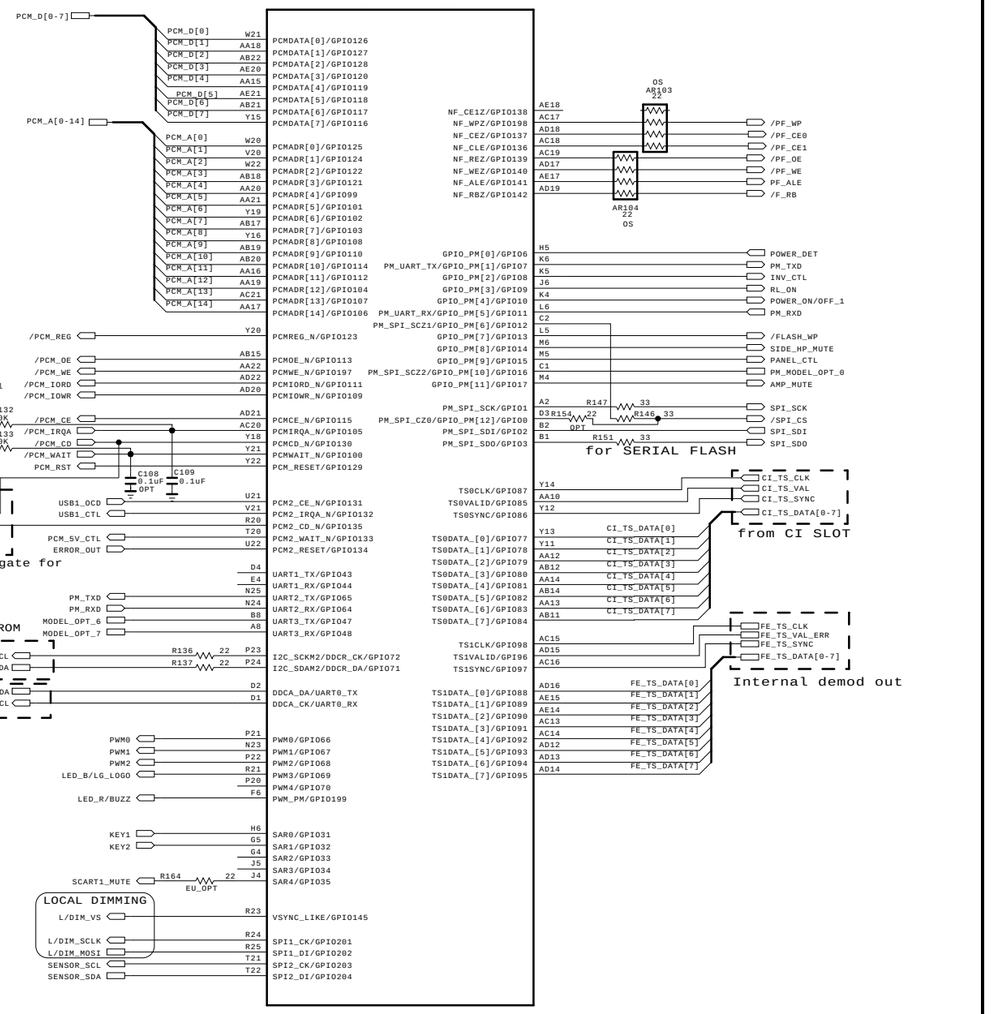
Boot from SPI CS1N(EXT_FLASH) 1'b0
Boot from SPI_CS0N(INT_FLASH) 1'b1

<CHIP Config>
(I2S_OUT_BCK,I2S_OUT_MCK,PAD_PWM1PAD_PWM0)

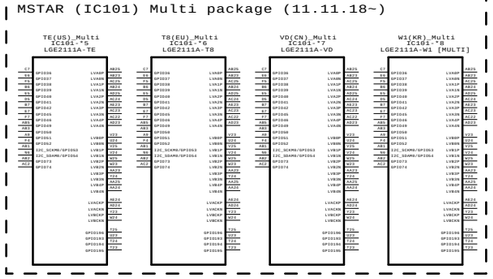
B51_no_EJ	: 4'b0000	Boot from 8051 with SPI flash
SB51_WOS	: 4'b0001	Secure B51 without scramble
SB51_WS	: 4'b0010	Secure B51 with scramble
MIPS_SPI_NO_EJ	: 4'b0100	Boot from MIPS with SPI flash
MIPS_SPI_EJ_1	: 4'b0101	Boot from MIPS with SPI flash
MIPS_SPI_EJ_2	: 4'b0110	Boot from MIPS with SPI flash
MIPS_WOS	: 4'b1001	Secure MIPS without scramble
MIPS_WS	: 4'b1010	Scerur MIPS with SCRAMBLE



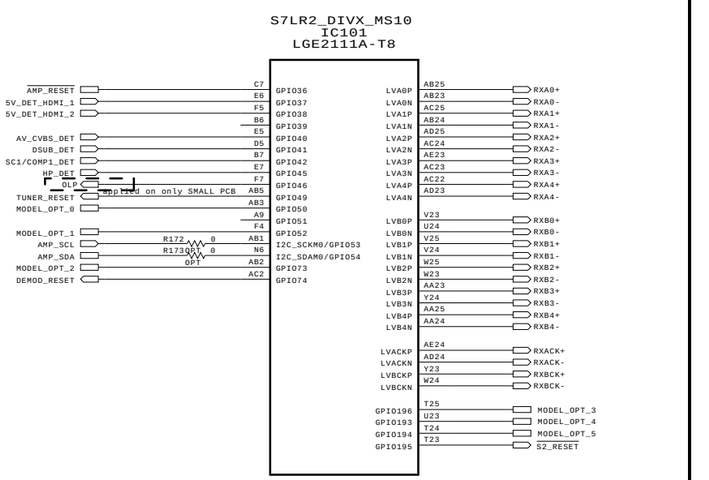
S7LR2_DIVX_MS10
IC101
LGE2111A-T8



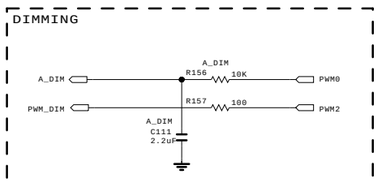
MSTAR (IC101) Multi package (11.11.18~)



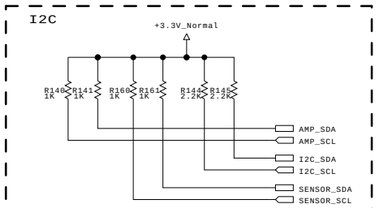
S7LR2_DIVX_MS10
IC101
LGE2111A-T8



DIMMING

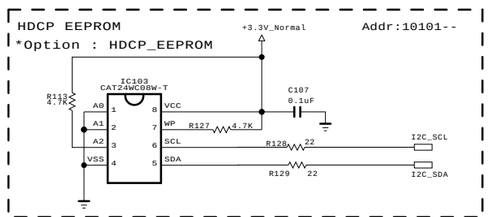


I2C

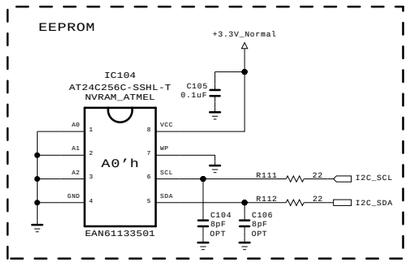


HDCP EEPROM

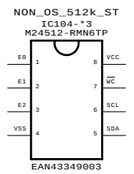
*Option : HDCP_EEPROM



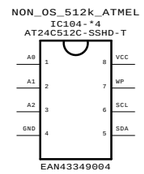
EEPROM



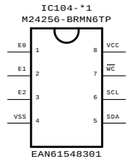
NON_OS_512k_ST



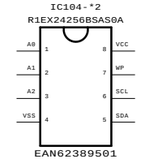
NON_OS_512k_ATMEL



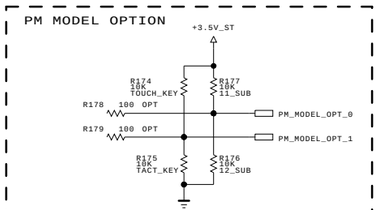
NVRAM_ST



NVRAM_RENESAS



PM MODEL OPTION



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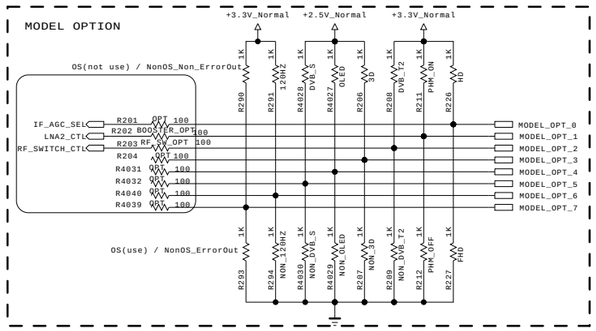
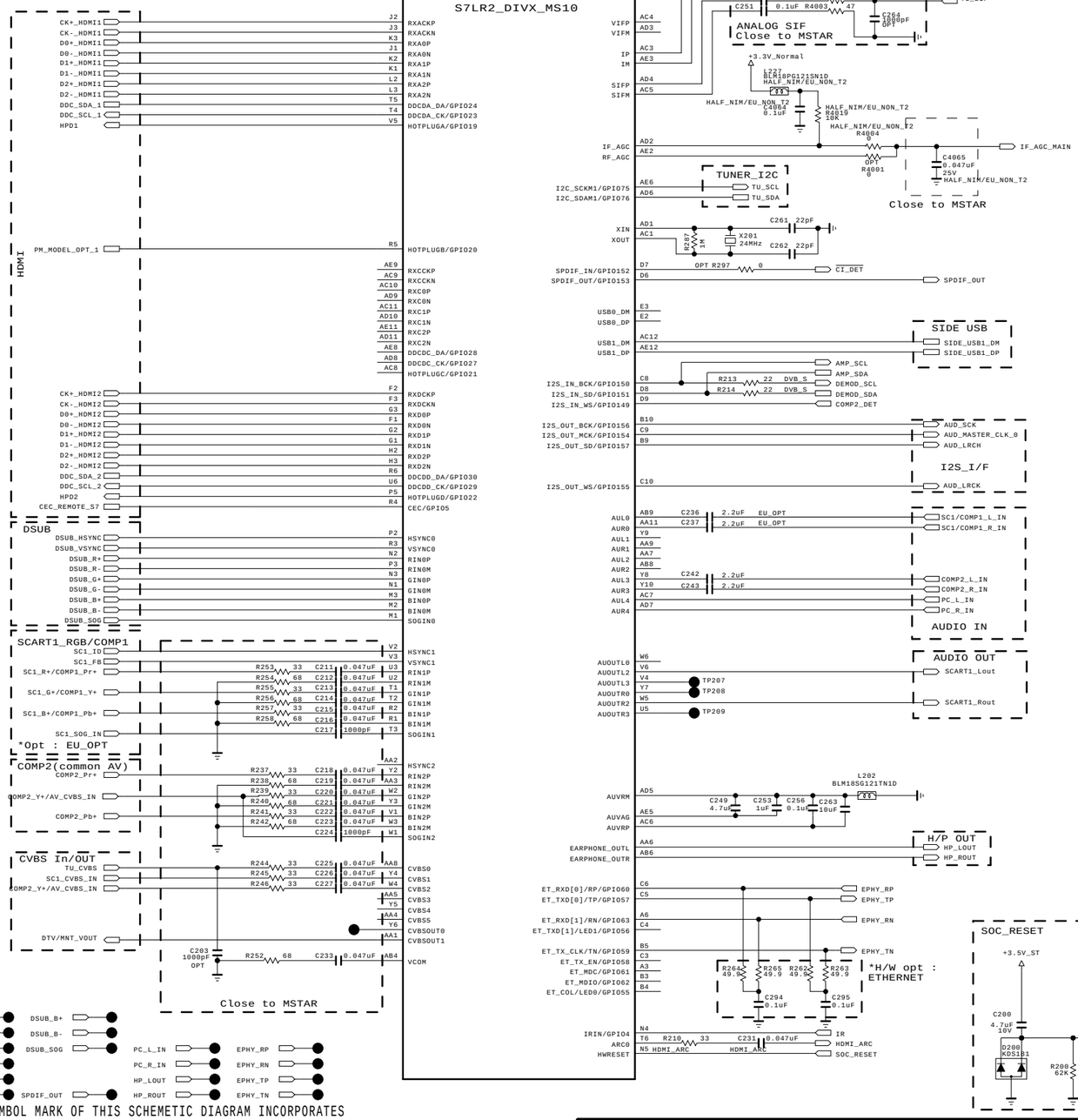
LG ELECTRONICS

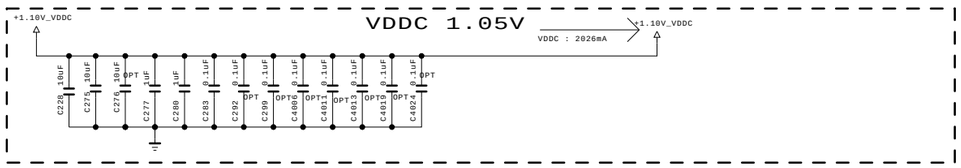
MODEL	GP4L_S7LR2	DATE	2011.11.02
BLOCK	FLASH/EEPROM/GPIO	SHEET	50

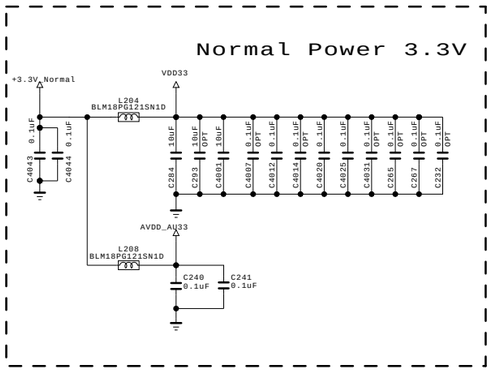
MODEL OPTION

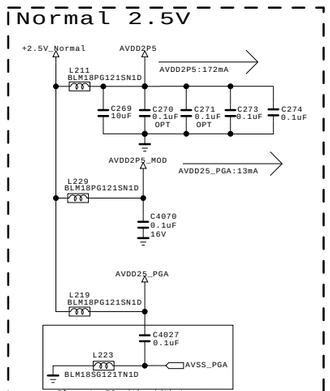
PIN NAME	PIN NO.	LOW	HIGH
MODEL_OPT_0	AB3	FHD	HD
MODEL_OPT_1	F4	PHM_OFF	PHM_ON
MODEL_OPT_2	AB2	NON_DVB_T2	DVB_T2
MODEL_OPT_3	T25	NON_3D	3D
MODEL_OPT_4	U23	NON_OLED	OLED
MODEL_OPT_5	T24	NON_DVB_S	DVB_S
MODEL_OPT_6	B8	NON_120HZ	120HZ
MODEL_OPT_7	A8	OS(use) NonOS_ErrorOut	OS(not use) NonOS_Non_ErrorOut

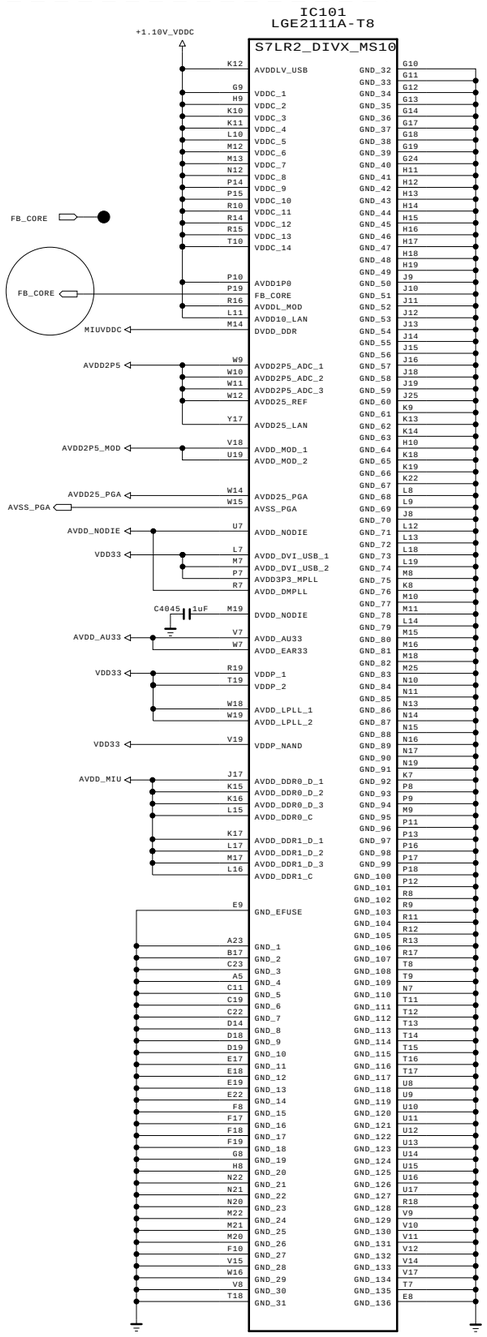


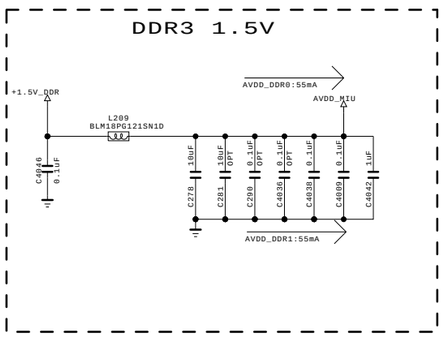


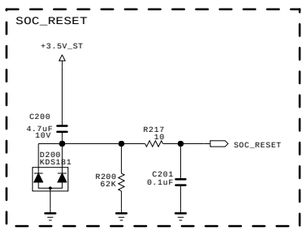


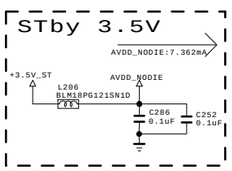


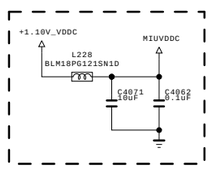












THE ⚠ SYMBOL MARK OF THIS SCHEMETIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION. FILRE AND ELECTRICAL SHOCK HAZARDS, WHEN SERVICING IF IS ESSENTIAL THAT ONLY MANUFATURES SPECFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE ⚠ SYMBOL MARK OF THE SCHEMETIC.

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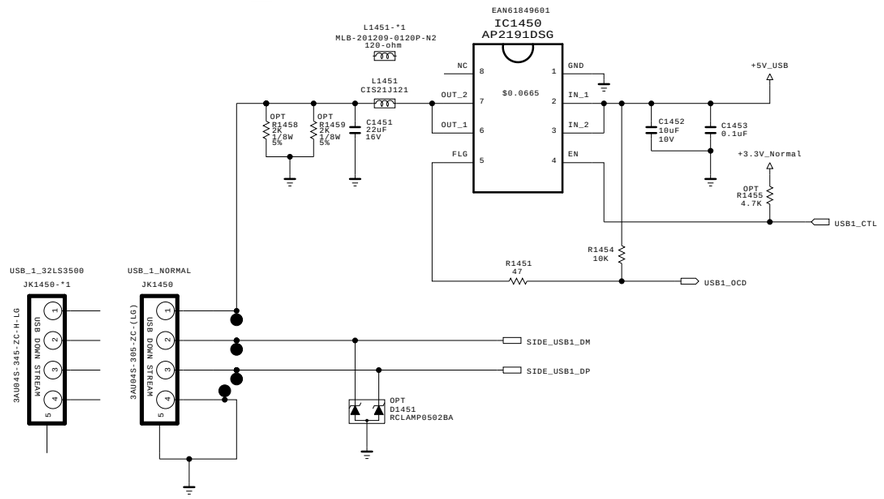
MODEL	GP4L_S7LR2	DATE	2011.08.24
BLOCK	POWER,IN/OUT,H/W OPT	SHEET	51

USB (SIDE)

USB1_DIODES



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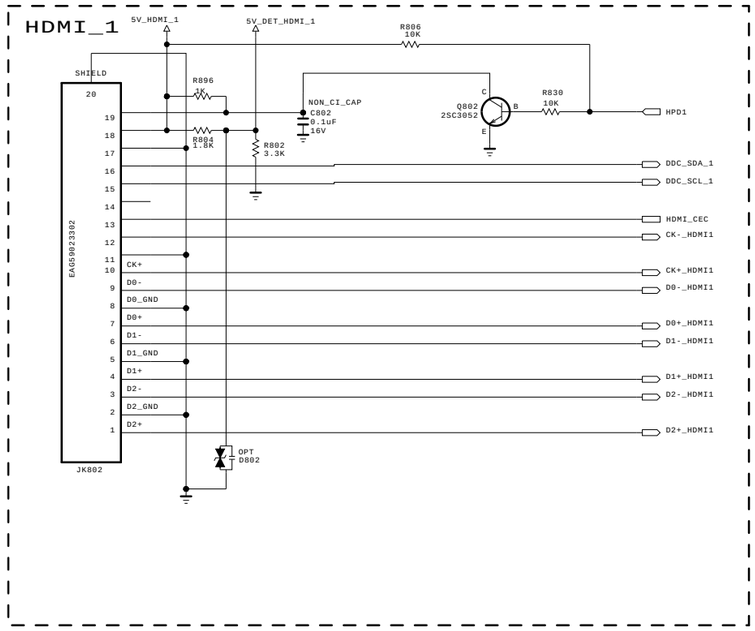
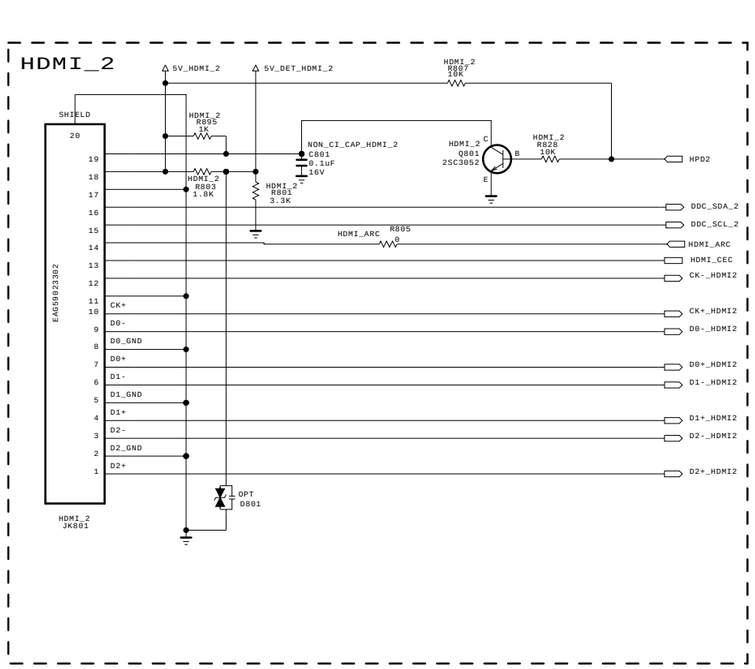
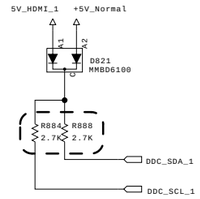
LG ELECTRONICS

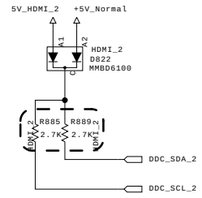
MODEL	GP4L_S7LR2	DATE	2011/11/18
BLOCK	USB_OCP_DIODE_1EA	SHEET	52

HDMI_2EA(NON SIDE HDMI)

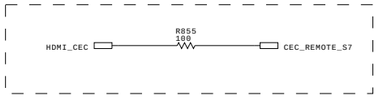








For CEC



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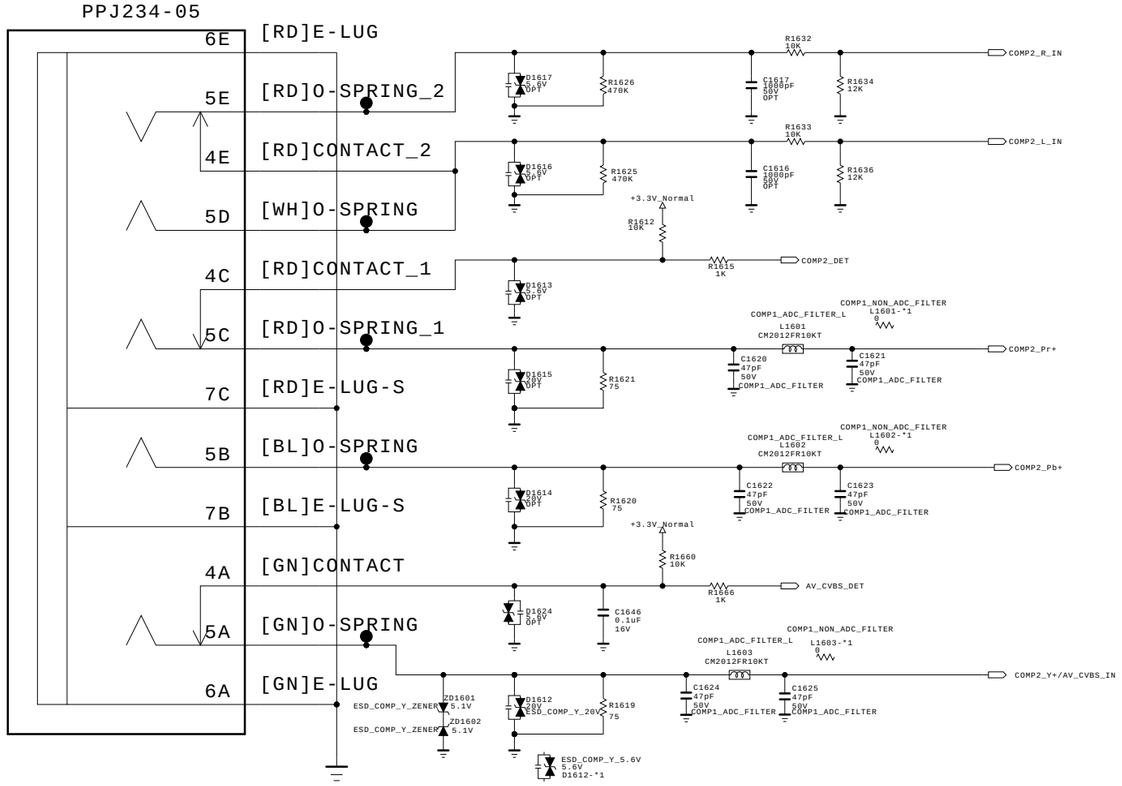
LG ELECTRONICS

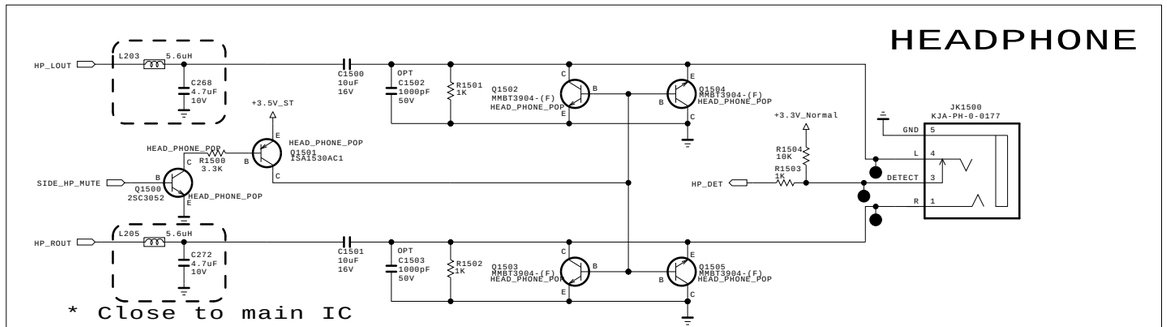
MODEL	GP4L_S7LR2	DATE	2011/08/12
BLOCK	HDMI_2EA(NON SIDE HDMI)	SHEET	53

REAR JACK for non-EU (ERRC)

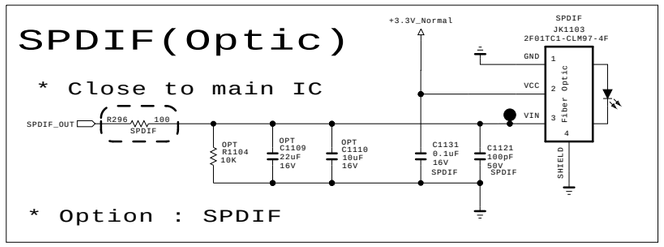
COMPONENT & AV(COMMON)



HEADPHONE

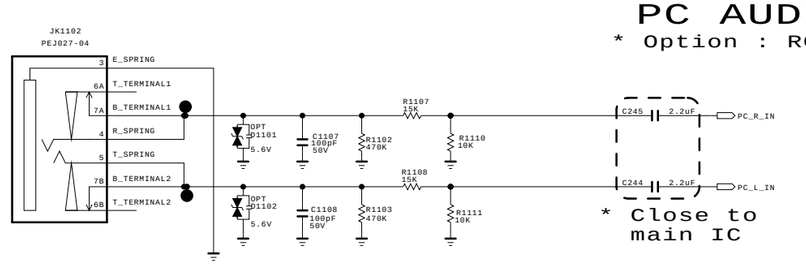


SPDIF(Optic)



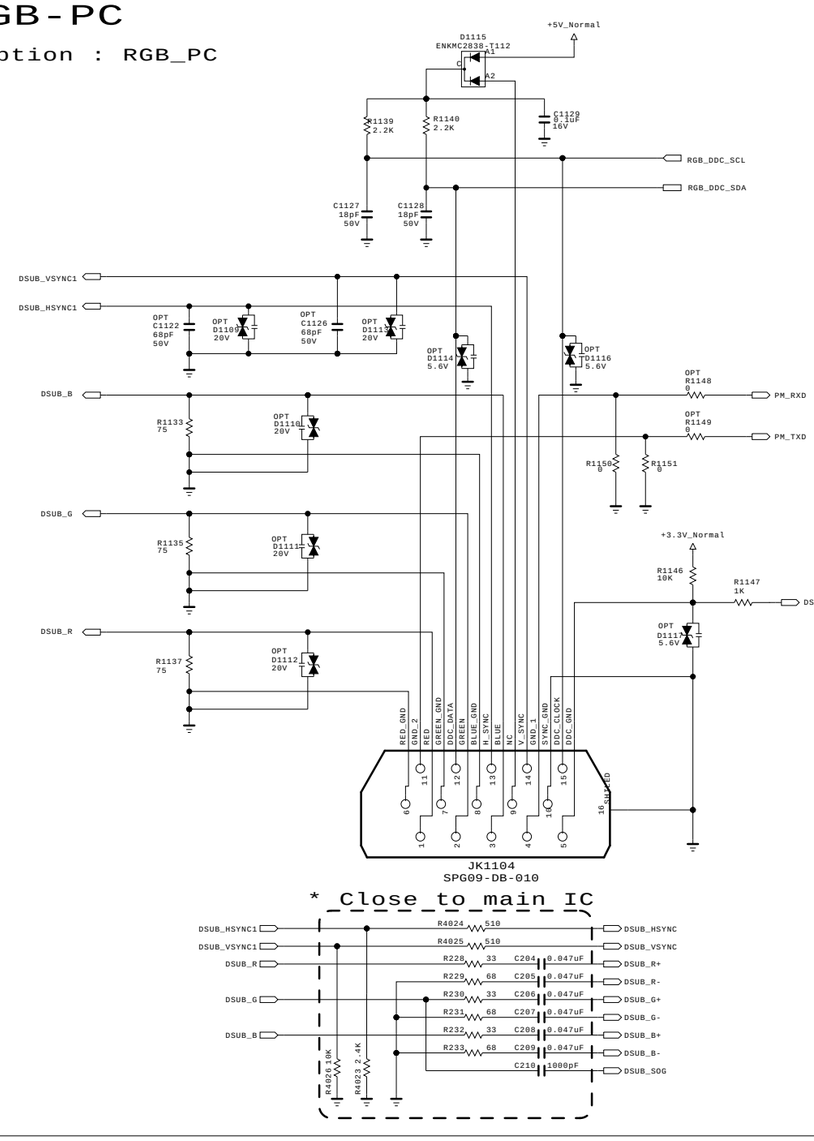
PC AUDIO

* Option : RGB_PC



RGB-PC

* Option : RGB_PC



SC1/COMP1_R_IN
SC1/COMP1_L_IN
SC1_R+/COMP1_Pr+
SC1_B+/COMP1_Pb+
SC1/COMP1_DET
SC1_G+/COMP1_Y+

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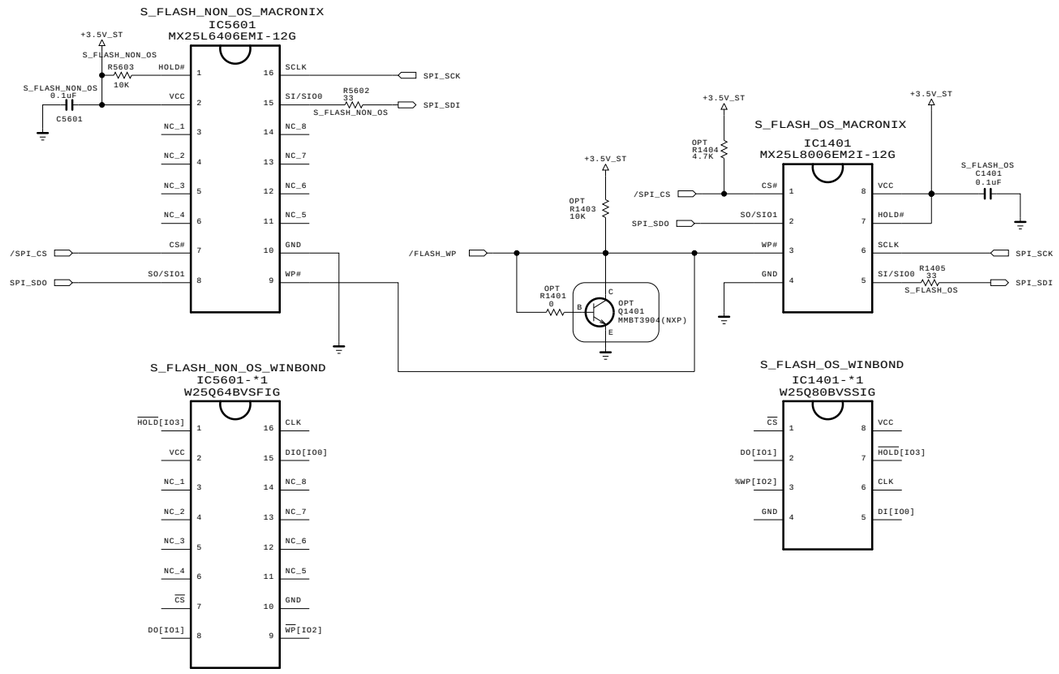
LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011.10. 14
BLOCK	REAR_NON_EU_ERRC	SHEET	54

Serial Flash for SPI boot_NON_OS and OS



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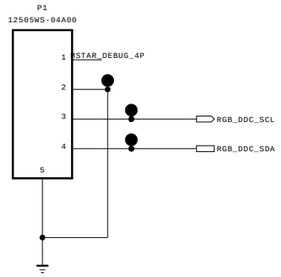
LG ELECTRONICS

MODEL	GP4L_S7LR	DATE	2011.08.29
BLOCK	Serial FLASH	SHEET	56

MSTART DEBUG_4PIN



THE ⚠ SYMBOL MARK OF THIS SCHEMETIC DIAGRAM INCORPORATES
SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION.
FILRE AND ELECTRICAL SHOCK HAZARDS, WHEN SERVICING IF IS
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LG ELECTRONICS

MODEL	GP4L_S7LR2	DATE	2011/09/05
BLOCK	MSTAR DEBUG_4PIN	SHEET	58


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